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THE
Young Gentleman's
TRIGONOMETRY, MECHANICKS, AND OPTICKS.

Containing ſuch
ELEMENTS of the ſaid Arts
or Sciences, as are moſt Uſeful
and Eaſy to be known.

By *EDWARD WELLS*, D.D.
Rector of *Cotesbach* in *Leiceſter-ſhire.*

LONDON,
Printed for *James Knapton*, at the *Crown*
in St. *Paul's* Church-Yard. 1714.

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BRITAN
NICVM

THE

PREFACE.

BEING *once prevail'd upon to draw up the* Young Gentleman's Geometry, I *judg'd it requiſite alſo to draw up this Treatiſe of* Trigonometry; *foraſmuch as Trigonometry is really no other than one Branch of Geometry, and that too a Branch, which is of principal Vſe in the common Concerns of Life; at leaſt that Part of it, which is call'd* Plain *Trigonometry. As for* Spherical *Trigonometry, it carrying in it much more of Difficulty, and at the ſame time being of much leſs Vſe in the common Affairs of Life, (as relating chiefly to Aſtronomical Calculations or the like,) I have omitted it,* *as not agreeabls to the Deſign of this Treatiſe.*

On the like Account, tho' I judg'd it not proper wholly to omit the Fundamental Theorems *of plain* Trigonometry; *yet I have plac'd them ſo in* Chap. II. *that the young Student may paſs them over, without any Abruptneſs, if the Demonſtration of the two latter prove too difficult, or at leaſt if he cares not to take the Pains to make himſelf Maſter of the ſaid Demonſtrations.*

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THE

Young Gentleman's TRIGONOMETRY.

CHAP. I.

Containing the Explication *of Trigonometrical Terms.*

EVERY Triangle conſiſts in all of ſeven Parts, *viz.* three Sides, three Angles, and the Area or Space comprehended by the Sides. Now, although the Word *Trigonometry* do's in the *Greek* Language literally ſignify *the Meaſuring of a Triangle*; yet, in its proper Senſe, or as it is diſtinguiſh'd from *Geometry*, it (do's not denote the Meaſuring of the *Area* of a Triangle, this being deduced from (*) other than what are

1. Trigonometry, *what.*

(*) The Meaſuring of the Area of a plain right-lin'd Triangle, is deduced from the Principles of *Geometry*, (as are properly call'd Trigonometrical Principles, but it) denotes only the Meaſuring, or rather the Art of finding the Meaſure of, the unknown *Sides and Angles* of a Triangle, by the Help of thoſe that are given or known.

2. *The* Solution *of a Triangle, what.*

And the actual finding of the unknown Sides and Angles of a Triangle, is call'd, in one Word, the *Solution* or *Reſolving* of a Triangle.

3. *The Solution of Triangles on what* founded.

The Solution of Triangles is founded on that mutual Proportion, which is between the Sides and Angles of any Triangle. And this Proportion is known by finding the Proportion, which the Ray of a Circle has to certain other right Lines apply'd to the ſame Circle. And theſe right Lines are diſtinguiſh'd in general by the Names of *Chords*, *Sines*, *Tangents*, and *Secants*.

4. *A* Chord, *what.* *Fig.* 1.

A (†) *Chord* is a right Line drawn from one Extremity of any Arch to the other. Thus, *Fig.* 1, CH is the Chord,

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(as diſtinguiſh'd from *Trigonometry*,) viz. from *Theorem* 7, *Chap.* 1, *of the Young Gentleman's Geometry.* And the Meaſuring of the Area of a ſpherical Triangle, is deduced from the Meaſuring of a ſpherical Surface.

(†) As an *Arch* is ſo call'd, becauſe it reſembles a bent *Bow*; ſo a *Chord* is ſo call'd, becauſe it reſembles the *String* of a bent Bow. It is otherwiſe call'd a *Subtenſe*, becauſe it *ſubtends*, (*i. e.* is extended under) the Arch from one End of it to the other.

both of the leſſer Arch CTH, and alſo of the greater Arch CDH. And it is to be noted, that a Chord of 60 Degrees, is always equal to the Ray of the ſame Circle.

5. *A* Sine, *or* right Sine, *what.*

A (‖) *Sine* is either a Right or Verſed Sine. A *right Sine* is one Half CA of a Chord CH, biſected by the Diameter DT; or, it is a Perpendicular CA, let fall from C one End of an Arch CT, upon a Diameter DT, drawn from T the other End of the Arch. A *right Sine* is frequently ſtil'd ſimply *a Sine*; and it is to be obſerv'd, that by the Word *Sine*, put ſimply or by it ſelf, is always to be underſtood a *right Sine.*

6. *A* total *or* whole *Sine, what.*

It is alſo to be obſerv'd, that, according to the fore-going Definition of a Sine, the Sine BK of an Arch KT of 90 Degrees, is always equal to the Ray of the ſame Circle; and ſo the greateſt Sine that can be. Whence it is call'd, the *total* or *whole* Sine.

7. *A* vers'd *Sine, what.*

A (*) *vers'd* Sine is the Segment of the Ray intercepted between the right

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(‖) The Uſe of *Sines* is ſaid to be introduced by the *Arabs*; and for what Reaſon a Sine is ſo call'd, I know no good Account.

(*) A vers'd Sine is otherwiſe call'd, at leaſt by ſome ancient Writers, the *Sagitta* or *Arrow*, becauſe it ſtands to its Arch and Chord, as an Arrow do's to its Bow (when bent) and String.

Sine and the Arch. Thus, AT is the vers'd Sine of the Arch CT, and AD the vers'd Sine of the Arch CD.

8. *A* Tangent, *and* Secant, *what.* A (†) *Tangent* and a *Secant* mutually explain one the other. For, if a right Line BN of an indeterminate Length be drawn from the Center B, through C one End of an Arch CT, and from T the End of the Diameter DT, there be erected a Perpendicular TN, extended till it meets with BN; the ſaid Perpendicular TN will be the Tangent of the Arch CT, and the Line BN will be the Secant of the ſame Arch. And it is to be noted, that the Tangent of 45 Degrees, is always equal to the Ray of the ſame Circle; as may be ſeen, *Fig.* 2.

9. *A* Coſine, Cotangent, Coſecant, *and* Covers'd, *what.* As when the Arch CT is leſs than 90 Degrees, the Arch CK (which, being added to the Arch CT, do's compleat or make it up an Arch of 90 Degrees, thence) is call'd the (||) *Complement* of the Arch CT; ſo (*Fig.* 1.) the Sine CQ, the Tangent KO, the Secant BO, and the vers'd Sine KQ of the Arch CK, are re-

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(†) A *Tangent* is ſo nam'd, becauſe it *touches* (not cuts) one End T of its Arch CT; and a *Secant* is ſo nam'd, becauſe it *cuts* or croſſes the other End C of its Arch CT.

(||) It is not to be omitted, that the Exceſs CK of the Arch CD above 90 Degrees, is by ſome Writers call'd, the *Complement* of the ſaid Arch CD.

ſpectively call'd the *Sine*, the *Tangent*, the *Secant*, and the *verſ'd Sine of the Complement* of the Arch CT; or in ſhort, the (*) *Coſine*, the *Cotangent*, the *Coſecant*, and the *Coverſ'd* of the ſaid Arch CT.

10. *The* Supplement *or* Conjunct *of an Arch, what.* The Arch CD, (which, being added to the Arch CT, makes it up a Semicircle,) is peculiarly (†) ſtil'd the *Supplement* or *Conjunct* of the Arch CT. And it is to be noted, that both the Arch CT, and its Conjunct CD, have the ſame Sine CA, the ſame Tangent TN, and the ſame Secant BN.

11. Tables *of Sines and Tangents, what.* *Tables* of (‖) Sines and Tangents are ſo call'd, becauſe in them is ſet down the Ratio or Proportion, which Sines and Tangents have to their Ray.

(*) It is of Uſe to obſerve, that the Coſine CQ is always equal to BA, the Segment of the Ray between the Center B, and the Sine CA. Wherefore, if the Arch CD be greater than 90 Degrees, then the Sum of the Ray and Coſine is equal to the verſ'd Sine; *viz.* DB+BA=DA. But, if the Arch CT be leſs than 90 Degrees, then the Difference of the Ray and Coſine is equal to the verſ'd Sine, *viz.* BT−BA=AT,

(†) Namely, to avoid Confuſion by giving the ſame Name of *Complement*, both to CK and to CD, as is done by ſome.

(‖) It appears from §. 5, of this Chapter, that every Sine, (*i. e.* right Sine) is the Half of a Chord, and that the Arch of the Sine, is the Half of the Arch of the ſaid Chord. Wherefore, becauſe there is the ſame Proportion between two Halves, as there is between their Wholes, and the ſaid Proportion between the Halves

12. Natural *and* artificial *Sines and Tangents, what.*

And it is to be noted, that, if the ſaid Proportion be expreſs'd in the Tables by natural or common Numbers, then the Table is call'd, a Table of *natural* Sines and Tangents. But, if the ſaid Proportion be expreſs'd by artificial Numbers, *i. e.* Logarithms, then the Table is call'd, a Table of (*) *artificial* Sines and Tangents.

13. *A* Scale or Line *of Chords, Sines, Tangents, and Secants,* &c. *what.* *Fig.* 2.

If the ſaid Proportion be not expreſs'd by Numbers, but the ſeveral Sines and Tangents, as alſo (†) Chords and Secants, be themſelves actually transferr'd into, (*i. e.* their ſeveral Lengths ſet off upon) ſeveral diſtinct Scales or Lines, (as *Fig.* 2); then the ſaid Scales or Lines are reſpectively

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(as being expreſſible in leſs Numbers) is much eaſier to be calculated, than the Proportion between their Wholes; hence, Sines are uſed rather than Chords in Trigonometrical Calculations, and the Proportion of Sines (not of Chords) to the Ray is ſet forth in Trigonometrical Tables.

(*) It has been afore obſerv'd in my *Arithmetick*, that the *Multiplication* and *Diviſion* of great Numbers is much eaſier to be perform'd by Logarithms than natural Numbers. Hence it is that Tables of artificial Sines and Tangents, are more uſed than thoſe of natural Sines and Tangents, and conſequently adjoin'd to moſt Trigonometrical Treatiſes.

(†) The Reaſon, why there are no Tables of Chords, has been obſerv'd already in the Note on §. 11. There are however *Scales of Chords*, theſe being as eaſily made as *Scales of Sines*, and as eaſy or eaſier for Uſe in ſome Reſpects. And the like is to be underſtood of *Secants*, *viz.*

reſpectively ſtil'd, one *a Scale* or *Line of Chords*, the other *of Sines*, the other *of Tangents*, and the other *of Secants*. And the like is to be underſtood of the Scales of any other Sort of Trigonometrical Lines, as of vers'd Sines, Coſines, *&c.*

14. *A Scale of* equal Parts, *what.* *Fig.* 3, & 4.

Beſides the fore-mention'd Scales, there is alſo another Sort of Scale, call'd a *Scale of equal Parts*; which, although it

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viz. as to the Reaſon, why there are few or no *Tables* of them, but there are uſually, if not always, *Scales* of them adjoin'd to the other Scales. If it be aſk'd, why the Scale of Chords is never continued beyond 90 Degrees, when the greateſt Chord is the Diameter or Chord of 180 Degrees? The Reaſon is, becauſe the Chords *above* 90 Degrees, may be very eaſily ſupply'd by a Scale of Chords *to* 90 Degrees, *viz.* Chord of 105 Degrees = Chord 90 Degrees + Chord 15 Degrees. And ſo of any other to 180 Degrees. The Reaſon, why Tables and Scales of Sines go no further than 90 Degrees, is obvious, *viz.* becauſe a Sine of 90 Degrees, is the greateſt Sine that can be, as appears from §. 5, and 6, of this Chapter. In like manner, the greateſt Tangent and Secant is of 89 Degrees, 59 Minutes. For, at 90 Degrees, Lines drawn in like manner as a Tangent and Secant, become parallel one to the other, and ſo never meet to conſtitute a Tangent and Secant, at leaſt properly ſo call'd. Hence Tables of Tangents proceed only to 89 Degrees, 59 Minutes. And as for Scales of Tangents, and alſo Secants, they are uſually continued no farther than to about 70 or 75 Degrees; becauſe, after that they extend to a vaſt Length, if the Scales be of any conſiderable Size, ſo as to be fit for Uſe. Which may be perceiv'd by *Fig.* 2, where the Scales are of a very ſmall Size, as being deſign'd not ſo much for practical Uſe, as to ſhew only the Manner of Making ſuch Scales. Such Scales, as are fit for Practice, are to be bought ready made of ſuch as ſell Mathematical Inſtruments.

be not deduced from Principles of Trigonometry, yet is of ſo great Uſe therein, (as well as in other Parts of the Mathematicks,) that it will be requiſite to deſcribe it here, eſpecially, ſince it has not been afore deſcrib'd. It is then call'd, *a Scale of equal Parts*, becauſe it ſhews the Meaſure of any Line or Extent, apply'd thereto, or taken therefrom, in ſome Number of *equal Parts*, denoting either Inches, or Feet, or Yards, *&c.*

15. *A* ſimple *or* plain *Scale of equal Parts, what.*

It is uſually diſtinguiſh'd into the *ſimple* or *plain* Scale, and the *diagonal* Scale. The *ſimple* or *plain* Scale, is no other than a right Line divided into any Number of equal Segments or greater Parts: One of which greater Parts, (*viz.* at either End of the ſaid Line,) is ſub-divided into Ten other leſſer and equal Parts, as *Fig.* 3; So, that this Scale repreſents any two Degrees of decuple Proportion, *viz.* if the Sub-diviſions of the Segment BA be taken to denote Units, then the other equal Segments CB, DC, *&c.* will denote Tens. If the aforeſaid Sub-diviſions denote Tens, then the Segments will denote Hundreds, *&c.* Hence, the Extent from C to 4 will denote either 14 or 140 (*&c.*) Inches, or Feet, or Yards, *&c.*

16. *A diagonal Scale what.*

The *diagonal* Scale will be better apprehended by *Fig.* 4, than by Words. It thence appears to differ from the ſimple Scale principally in this, *viz.* that one of its extreme Segments (being like the ſimple Scale) ſubdivided into ten equal Parts, each of the ſaid ten equal Parts, are again ſubdivided into ten other ſtill leſs and proportional Particles, by ten right Lines obliquely croſſing the Scale, which are the *Diagonals* of ſo many (‖) Parallelograms; whence this Scale takes its Name. Hence, by the Diviſions and Sub-diviſions of this Scale, are repreſented three Degrees of decuple Proportion.

(‖) This is illuſtrated, *Fig.* 5, which is divided after the ſame manner, as is the Segment KL of the diagonal Scale, *Fig.* 4; and has withal the *Sides* of each Parallelogram deſcrib'd by *prickt* Lines, ſo that the ſaid Figure contains five Parallelograms, *viz.* ABCD, and CDEF, and EFGH, and GHIK, and IKLM; which are each croſs'd by Diagonals, *viz.* the firſt by the Diagonal CB, the ſecond by the Diagonal ED, the third by the Diagonal GF, the fourth by the Diagonal IH, and the fifth by the Diagonal LK. And theſe Diagonals anſwer the right Lines obliquely croſſing the Segment KL of the diagonal Scale, *Fig.* 4, and which divide each Part of the ſaid Segment into leſs and proportional Particles, as is illuſtrated by *Fig.* 6. For the Lines *bk*, and *cl*, and *dm*, &c. being all parallel one to the other, hence (by *Theorem 9, Chap.* 1, *of the Young Gentleman's Geometry*) $ab : bk :: ac : cl :: ad : dm :: ae : en :: af : fo$, &c. But $ab =$ to ax; $ac = \frac{2}{10} ax$, $ad = \frac{3}{10} ax$, &c. therefore $bk = \frac{1}{10} ux$, $cl = \frac{2}{10} ux$, $dm = \frac{3}{10} ux$, &c. And conſequently, the Line *ux* is divided by the Diagonal *au*, into ten leſſer and proportional Parts, *viz.* *bk*, *cl*, &c.

portion. For Inſtance: If you would denote the Extent of 245 equal Parts, (*viz.* Inches or Feet, *&c.*) one Foot of your Compaſſes being placed in the middle or prickt Line over-againſt 200, open the other Foot to that Point of the Subdivided Segment KL, wherein meet the two Lines mark'd, one with 40 on the Side of the Scale, the other with 5 on the Top of the Scale. That Extent of your Compaſſes will denote 245 equal Parts, (*viz.* Inches or Feet, *&c.*) according to the ſaid Scale.

17. Plain *and* ſpherical *Trigonometry, what.* Further, It is to be here obſerv'd, that *Trigonometry* is two-fold, *Plain* and *Spherical.* *Plain Trigonometry* is ſo call'd, becauſe it teaches how to reſolve any (*) plain (*i. e.* right-lin'd) Triangle: *Spherical Trigonometry* is ſo call'd, becauſe it teaches how to reſolve any *ſpherical* Triangle, *i. e.* any Triangle whoſe Sides are made by the Concurrence of Lines on a ſpherical Surface, and are no other than the Arches of Circles. It will be ſufficient to the (†) Deſign of this Treatiſe, to ſpeak only of plain *Trigonometry.*

(*) Hence, by a *plain* Triangle is to be underſtood throughout this Treatiſe a *right-lin'd* Triangle.

(†) See the Preface.

Laſtly,

18. *Laſtly*, The Solution of plain (as alſo of ſpherical) Triangles is two-fold, either by *Calculation*, *i. e.* Working by Numbers, to which are ſubſervient the Tables of Sines and Tangents; or by *Protraction*, *i. e.* drawing Lines and Angles, to which are ſubſervient the Scales of Chords, Sines, *&c.* of each in its Order; and firſt of the Solution of plain Triangles by Calculation.

Calculation *and* Protraction, *what.*

CHAP. II.

Of the Solution of plain Triangles by Calculation,

1. OF the ſix Trigonometrical Parts of a plain Triangle, *viz.* its three Sides, and three Angles, any three being given, excepting the three Angles alone, the reſt may be found either by Calculation or Protraction. From the three Angles given by themſelves, can be inferr'd or found out, only the *Proportion* of the Sides, not the *Sides* themſelves, or their reſpective determinate Lengths. For Inſtance: Suppoſing the three Angles of the Triangle BCD, *Fig.* 7, to be given, *viz.* B $27\frac{1}{4}$ Degrees, D $38\frac{1}{2}$ Degrees, and conſe-

In order to reſolve a plain Triangle, there muſt be always given one Side, *and why.* *Fig.* 7, & 8.

conſequently, C 114$\frac{1}{4}$ Degrees; from hence it may be known, that the Side CD=$\frac{1}{2}$BD, and the Side CB=$\frac{2}{5}$BD. But from hence can never be diſcover'd the determinate Length of BD, (or any other Side,) and conſequently not of the Reſt CB and CD. Namely, becauſe $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{10}{20}=\frac{100}{200}$, *&c.* hence the Proportion of CD to BD will be the ſame, whether BD be 2 Inches (or Feet, *&c.*) and CD one; or BD 4 Inches, and CD 2; or BD 6 Inches, and CD 3; or BD 20 or 200 Inches, and CD 10 or 100, *&c.* That is in ſhort, it can never be diſcover'd by the three Angles alone, whether the Triangle ſought be BCD, *Fig.* 7, or BCD, *Fig.* 8, (or any other equiangular Triangle,) foraſmuch as both theſe Triangles have the ſame Angles, and conſequently their Sides alike proportional one to the other; though the Sides of the one are much longer than the Sides of the other. Wherefore, to *determine the Length* of the Sides ſought, there *muſt always be given one Side*, or (which is the ſame) its determinate Length; and hereby will be determin'd the Length of each Side ſought. Thus, the Side BD, (*Fig.* 7,) being given, whoſe Length according to the diagonal Scale, (*Fig.* 4.) is 324 (equal Parts, ſuppoſe) Inches; hence, it being found, that CD=$\frac{1}{2}$BD, and CB=

^{2}BD,

BD, thereby it is known, that CD= 162 Inches, and CB=216 Inches. But, if the Side BD (*Fig.* 8,) be given, whoſe Length according to the ſame Scale is 135 (equal Parts, ſuppoſe) Inches; then in the ſame, *Fig.* 8, CD= $67\frac{1}{2}$ Inches, and CB=45 Inches.

2. *The Solution of plain Triangles reducible to* three general Caſes.

It evidently appearing from what has been ſaid, that, in order to reſolve a plain Triangle, of the three Parts given, one muſt be always a Side; it hence follows, that all the Caſes, that can be propos'd, are reducible *in general* to theſe *Three*, viz.

1. One Side and two Angles being given, to find the other two Sides, and the (*) third Angle: Or,

2. Two Sides and one Angle being given, to find the third Side, and the two other Angles: Or,

3. and laſtly, All the three Sides being given, to find the three Angles.

3. *All the* particular *Caſes are contain'd in the two following Tables.*

Theſe three general Caſes are diſtinguiſh'd into a great Variety of *particular* Caſes, (according to the particular Sides

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(*) Two Angles being given, the third may be known (without *Trigonometry*) by *Corol.* 1, *Theorem* 4, *of the Young Gentleman's Geometry.* And by the ſame Corollary, one Angle being given in *Caſe* 2, and one of the ſought being found, the other ſought is known. And ſo in *Caſe* 3, two of the Angles ſought being found, the third ſought is known.

and Angles given or ſought,) which are all contain'd in the two following Tables. Whereof, the former contains all the particular Caſes, that relate to the Solution of plain *rectangular* Triangles; and the latter contains all the particular Caſes, that belong to the Solution of plain *obliquangular* Triangles.

4. *The* literal Symbols *of the ſeveral Parts of a plain Triangle.* *Fig.* 9, & 10.

In Reference to which Tables it is to be obſerv'd, that for Brevity's ſake it is uſual to denote the ſeveral Parts of a plain Triangle by *Letters*, inſtead of Words. In order whereto a rectangular Triangle is wont to be denoted by A, B, and C, ſo placed, as (*Fig.* 9, *viz.*) that A always denotes the right Angle, BA the Baſis, CA the Cathetus or Perpendicular, which falling upon the Baſis makes the right Angle; BC the Hypotenuſe; B the Angle between the Baſis and Hypothenuſe, call'd in ſhort, *the Angle at the Baſis*; C the Angle between the Cathetus and Hypotenuſe, call'd in ſhort, *the Angle at the Cathetus*. And an obliquangular Triangle is wont to be denoted by B, C, and D, ſo placed, as (*Fig.* 10, *viz.*) that by a Cathetus CA, let fall from C, it may be divided into two Triangles, the Cathetus CA being a common Side to both Triangles. And then, as BD is eſteem'd the Baſis of the whole Triangle BCD, ſo BA and DA are the particular Baſes, and BC and DC the particular Hypotenuſes of the two Triangles BCA and DCA. Hence, B and D denote the two Angles at the Baſis BD of the whole Triangle BCD; whereof B is always the Angle oppoſite to the Side CD, and D the Angle oppoſite to the Side CB, as C is always the Angle oppoſite to the Baſis BD.

5. Other Symbols *uſed in the following Tables.*

It is likewiſe to be obſerv'd, that in the following Tables, the Letter *s* denotes a Sine, *t* a Tangent, and the *Greek* σ a Coſine. Thus, *Tab. I, Caſe* 1, *t*B denotes the Tangent of the Angle B. And *Caſe* 3, *s*C denotes the Sine of the Angle C. And *Tab. II, Caſe* 16, σB and σD denote the Coſines of the Angles B and D. Alſo note, that Z do's (in this Treatiſe, as in *Algebra*) denote the Sum of two Things; X their Difference. *Laſtly*, This Character ∠ denotes an Angle, ∠∠ two Angles; *l* a Leg or Side, *ll* two Legs or Sides. And conſequently, Z*ll* denotes the Sum of two Legs of a Triangle; Z∠∠ the Sum of two Angles, *&c.*

6. *Some other* Obſervations *in Reference to the two following Tables.*

It is alſo to be obſerv'd, that a right Angle being always 90 Degrees, hence it is put down, neither among the Parts *given*, nor the Parts *ſought*, in the ſeveral Caſes of *Tab. I.* As for the other two oblique Angles of a plain rectangular Triangle, they are both put down among the Parts *given* in each of the firſt ſix Caſes in *Tab. I*, (not (†) becauſe it is neceſſary both the ſaid Angles ſhould be actually given, but) becauſe one of them being given, the other is in effect given alſo, its Quantity being known (by *Corol.* 1, Theorem 4, of the *Young Gentleman's Geometry*,) to be the Complement of the given oblique Angle. On this and the like Accounts, ſome Tables are drawn up in a much more contracted or ſhorter Form, than the two which follow. But I judg'd it more agreeably to my Deſign, to have *all* the particular Caſes *diſtinctly* ſet down: So, that the young Student may, both more readily find the Caſe propos'd to him; and alſo, having found it, may more readily perform the Calculation, having Nothing elſe to do, but to Work according to the Proportion, which anſwers to the Caſe propos'd.

(†) Hence it is ſaid in the firſt ſix Caſes of *Table* I, thus, *viz.* B *or* C, denoting, that if either be given, it is ſufficient.

TABLE I.

Shewing the Solution of plain *rectangular* Triangles.

Caſe.	Parts given	Sought.	Proportions.
1	B or C . BA	CA	R : tB : : BA : CA.
2	B or C . CA	BA	R : tC : : CA : BA.
3	B or C . BA	BC	sC : R : : BA : BC.
4	B or C . CA	BC	B : R : : CA : BC.
5	B or C . BC	BA	R : sC : : BC : BA.
6	B or C . BC	CA	R : sB : : BC : CA.
7	BA . CA	B	BA : CA : : R : tB.
8	BA . CA	C	CA : BA : : R : tC.
9	BC . CA	B	BC : R : : CA : sB.
10	BC . BA	C	BC : R : : BA : sC.
11	BA . CA	BC	CA : R : : BA : tC ; & then sC : BA : : R : BC.
12	BC . BA	CA	BC : R : : BA : sC : & then tC : BA : : R : CA
13	BC . CA	BA	BC : R : : CA : sB ; & then tB : CA : : R : BA.

TABLE II.

Shewing the Solution of plain *obliquangular* Triangles.

Caſe	Given	Sought	Proportions.
1	BC . BD . D.	C	BC : BD : : sD : (‖) sC.
2	BC . BD . C.	D	BD : BC : : sC : sD.
3	BC . CD . D.	B	BC : CD : : sD : sB.
4	BC . CD . B.	D	CD : BC : : sB : sD.
5	BD . CD . C.	B	BD : CD : : sC : sB.
6	BD . CD . B	C	CD : BD : : sB : sC.
7	B.C.D . BC	BD	sD : BC : : sC : BD.
8	B.C.D . BC	CD	sD : BC : : sB : CD.
9	B.C.D . BD	BC	sC : BD : : sD : BC.
10	B.C.D . BD	CD	sC : BD : : sB : CD.
11	B.C.D . CD	BC	sB : CD : : sD : BC.
12	B.C.D . CD	BD	sB : CD : : sC : BD.

(‖) It is to be noted, that in this Caſe it may be doubtful, whether the Angle ſought C be Acute or Obtuſe. The Reaſon of which Doubtfulneſs ariſes from what is ſaid, §. 10, *Chap.* 1. This happens, when two Sides being given, whereof one is the greateſt Side, together with the Angle oppoſite to the leſſer of the given Sides, the Angle oppoſite to the greater of the given Sides is demanded. And, in this Caſe, the Doubtfulneſs can't be better taken away, than by Protracting the Triangle; as is ſhewn, *Chap.* 3.

Caſe.

Caſe	Given	Sought	Proportions.
13	BC . BD . B (†)	C or D	$\frac{BG+BD}{2} : \frac{BC-BD}{2} :: t\frac{D+C}{2} : (*)\,t\frac{C-D}{2}$. Then $\frac{D+C}{2} + \frac{C-D}{2} = C$, and $\frac{D+C}{2} - \frac{C-D}{2}$.
14	BC . CD . C (†)	B or D	$\frac{BC+CD}{2} : \frac{BG-CD}{2} :: t\frac{B+D}{2} : t\frac{B-D.}{2}$ Then $\frac{B+D}{2} + \frac{B-D}{2} = B$, and $\frac{B+D}{2} - \frac{B-D}{2} = B$.
15	BD . CD . D (†)	B or C	$\frac{BD+CD}{2} : \frac{BD-CD}{2} :: t\frac{C+B}{2} : t\frac{C-B.}{2}$ Then $\frac{C+B}{2} + \frac{C-B}{2} = C$, and $\frac{C+B}{2} - \frac{C-B}{2} = B$.
16	BC . GD . BD	B or D or C	DB : DG : : DF : DE. Then DB − DE = 2BA. And DB − BA = DA. Then CB : R : : BA : σB, and CD : R : : DA : σD. And Complement of B + D to 180 = C.

(*) It is to be obſerv'd, that, in this and the like Caſes, the Sum of the two Angles ſought, C and D, is found by ſubſtracting the Quantity of B, the Angle given, out of 180, according to *Theorem* 4, *of the Young Gentleman's Geometry.*

(†††) It is alſo to be obſerv'd in Reference to Caſe 13th, 14th, and 15th, that having found the three Angles B, C, and D, the third Side not given in either Caſe may be found by ſome of the twelve fore-going Caſes.

7. *The* Uſe *of the fore-going Tables illuſtrated, as to* artificial Sines, &c.

The Uſe of the fore-going Tables ſhall be illuſtrated by one or two Examples. And firſt, ſuppoſing of the rectangular Triangle ABC, (*Fig.* 9,) I have the Side BA given, *viz.* 8 (‖) Foot long, and the Angle B, *viz.* 36 Degrees, 52 Minutes; and it is requir'd to find the Side CA. I conſult the fore-going Tables, and find that this is *Caſe* 1, of *Tab.* I, and conſequently, that R : tB :: BA : CA, the Side requir'd. Hereupon I turn to my Table of artificial Sines, *&c.* whoſe Ray I find to be 10.000000, and the Tangent of 36 Degrees, 52 Minutes, to be 9.875010. Then in my Table of Logarithms, I find the Logarithm of 8 to be 0.903090. Having thus found the Numbers, that are to conſtitute the three firſt Terms of the Golden Rule in my Calculation, I then (according to the Method of Working the Golden Rule by Logarithms) add the 2d and 3d Terms, and out of the Sum ſubſtract the 1ſt Term, and the Reſidue is the 4th

Tangent of B 36 Degr. 52 Min.	9.875010
BA 8 f. long.	0.903090
Sum	10.778100
The Ray	10.000000
Reſidue	0.778100

(‖) This Extent of BA in *Fig.* 9, anſwers to the diagonal Scale, *Fig.* 4, and ſo of BC.

Term of my Proportion, and ſo the Number ſought, *viz.* 0.778100. I look for this Number in my Table of Logarithms, and (though I find not exactly the ſame Number, yet) I find one very near it, *viz.* 0.778151, the Logarithm of the Number 6. Wherefore, the Side requir'd CA is 6 Foot long very nearly, *viz.* wanting only $\frac{51}{1000000}$ of a Foot.

8. *The* Uſe *of the Tables illuſtrated, as to* natural *Sines*, &c.

The Reaſon, why the fore-going Example is wrought by artificial rather than natural Numbers, is, becauſe (as has been (*) afore obſerv'd) Tables of artificial Sines, *&c.* are more eaſy to work by, and ſo are generally made Uſe of, and therefore uſually adjoin'd to Books of *Trigonometry.* Whereas few Books have Tables of natural Sines, *&c.* Howſoever I ſhall here ſhew (for the Satisfaction of the more Curious) how natural Sines, *&c.* may be found by artificial Sines, and alſo, how the fore-going Example is to be wrought by natural Sines or Tangents, *&c.* when they are found.

If then you would have the natural Sine or Tangent of any Angle, and want a Table of them, but have a Table of artificial Ones; then look out the artificial Sine or Tangent in the Table, and

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(*) See the ſecond Note on §. 12, *Chap.* I.

not much regarding the Characteriſtick thereof, ſee what Number anſwers to the other Part thereof in the Table of Logarithms, and that will ſhew you the natural Sine or Tangent deſir'd. For Inſtance: Not regarding the Characteriſtick of the artificial Tangent (above-found) of B, *viz.* 9.875010, I look in the Table of Logarithms for the other Part, *viz.* 875010; and the neareſt to it, there to be found, is the Logarithm 875061, which anſwers to the Number 750, which, therefore may be taken as the natural Tangent ſought of the Angle B, the Difference being only $\frac{51}{1000000}$.

Having thus found the natural Tangent of B, if thereby you would find the Side CA requir'd; then you muſt place (as afore) the Terms according to the Direction anſwering to *Caſe* 1, *Tab.* I, and muſt work the Golden Rule, (as in natural Numbers, *i. e.*) by multiplying the 2d and 3d Terms together, and dividing the Product by the 1ſt Term. The Quotient will be the Number Sought or CA, *viz.*

Ray. (†)	Nat. Tang.	BA.	CA.
1000 :	750 : :	8 :	6.

(†) The Ray always conſiſts of an Unit, and ſo many Cyphers, as there are Figures in the (natural or artificial) Sine or Tangent.

For 750×8=6000, and 1000) 6000 (6. And thus the Length of the Side CA requir'd, hath been found to be 6 Foot by both Sort of Operations.

9. *Another Example.* Again, of the fore-mention'd Triangle ABC, ſuppoſe CA and B to be given, and BC to be requir'd. I find this to be *Caſe* 4, of *Tab.* I, and conſequently, the Rule for finding BC to be this, *viz.* sB : R : : CA : BC. Wherefore,

As artifi. Sine of B 36 Deg. 52 Min.	9.778119
To the Ray	10.000000
So CA 6 Foot long	0.778151
To BC the Side requir'd (10 f.)	1.000032.

For 10.000000+0.778151=10.778151; and 10.778151—9.778119=1.000032, which is (but $\frac{32}{1000000}$, *i. e.* is nothing different from 1000000) the Logarithm of the Number 10, which, therefore is the Meaſure of the Side requir'd BC. And thus having given the Side BA (=8 f.) of the Triangle ABC, the Side CA has been found equal to 6 Feet, and BC to ten Feet; agreeable to what is obſerv'd in the Uſe of *Theorem* 12, *of the Young Gentleman's Geometry*; whence may be obſerv'd the Truth of trigonometrical, as well as geometrical Principles.

10. *Of the* four Theorems, *on which plain* Trigonometry *is* founded.

I proceed now to ſpeak of the *fundamental Theorems* of *Trigonometry*, ſo call'd, becauſe on them is founded the Solution of plain Triangles, in all the Variety of Caſes contain'd in the two fore-going Tables. And theſe Theorems are four; on the firſt of which is founded, *Tab.* I, or the Solution of plain rectangular Triangles; and on the other three is founded, *Tab.* II, or the Solution of plain obliquangular Triangles.

THEOREM I.

Whereon is founded the Solution of plain rectangular Triangles.

Fig. 11.

In every plain rectangular Triangle ABC, if BC be the Ray, then BA is the Sine of the Angle C, and CA the Sine of the Angle B. If BA be the Ray, then BC is the Secant, and CA the Tangent of the Angle B. But, if CA be the Ray, then BC is the Secant, and BA the Tangent of the Angle C; as is illuſtrated, *Fig.* 11.

Whence it follows,

1. R : sB : : BC : CA.
2. R : sC : : BC : BA.
3. R : tB : : BA : CA.
4. R : tC : : CA : BA.

And theſe four Proportions are the ſame with thoſe appertaining to *Caſe* 6, 5, 1, and 2, of *Tab.* I, and from theſe are deduced all the other Proportions, belonging to the ſeveral other Caſes of *Tab.* I, as may be ſeen by comparing them together. And therefore it evidently appears, how on this fundamental Theorem 1, is founded *Tab.* I. Proceed we to Theorem 2.

THEOREM II.

Whereon is founded the Solution of plain obliquangular *Triangles, when, there being given either all the Angles with one Side, or two Angles with the Side oppoſite to one of the ſaid Angles, the Reſt are ſought.*

In every plain Triangle, the Sides are proportional to the Sines of the oppoſite Angles; that is, sB : DC :: sC : BD :: sD : BC. For $\frac{BC}{2} : \frac{CD}{2} :: sD : sB$, and $\frac{BC}{2} : \frac{BD}{2} :: sD : sC$, and $\frac{CD}{2} : \frac{BD}{2} :: sB ; sC$; as is illuſtrated, *Fig.* 12.

Fig. 12.

THEOREM III.

Whereon is founded the Solution of plain obliquangular *Triangles, when, there being given two Sides with the Angle contain'd between them, the Reſt are ſought.*

$\frac{Zll}{2} : \frac{Xll}{2} :: t,\frac{Z\angle\angle op}{2} : t\frac{X\angle\angle op}{2}$; *that is in Words*, as Half the Sum of the (Legs or) Sides given, is to Half the Difference of the Sides given ; ſo is the Tangent of Half the Sum of the oppoſite Angles ſought, to the Tangent of Half the Difference of the oppoſite Angles ſought : *Fig.* 13. That is, in *Fig.* 13, GE : BE :: GH : FH.

Demonſtration. In the Triangle BCD, *Fig.* 13, let the Legs or Sides given be BD and BC. Draw BG=BC ; and ſo there will be GE$=\frac{Zll}{2}$, and BE$=\frac{Xll}{2}$; and the (‖) extern Angle GBC=BCD+BDC, the two intern and oppoſite An-

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(‖) By *Theorem* 4, *Chap.* 1, *of the Young Gentleman's Geometry.*

gles of the Triangle BCD. Then draw CG, and after that draw EH, and alſo BF parallel to CD; whence will ariſe the Angle (*) GBF=BDC, and (†) FBC =BCD. Then biſect CG by BH, and there will ariſe the Angle (‖) GBH=HBC. But GBH+HBC=GBC=GBF+FBC=BDC+BCD, *i. e.* $Z\angle\angle opp$. And therefore, (becauſe GBH=HBC, and GBH+HBC=GBC,) GBH=$\frac{Z\angle\angle opp}{2}$; and ſo GH the Tangent of $\frac{Z\angle\angle opp}{2}$. Then make the Angle HBK=FBH. Now, becauſe (as afore has been ſhewn) the Angle GBH=HBC, therefore GBH—FBH =HBC—HBK, *i. e.* GBF=KBC. Wherefore FBC (BCD) —KBC (GBF or BDC) =FBK or $X\angle\angle opp$. Wherefore FBH= $\frac{X\angle\angle opp}{2}$; and ſo FH is the Tangent of $\frac{X\angle\angle opp}{2}$. But now GE : BE : : GH : IH, that is, $\frac{Zll}{2} : \frac{Xll}{2} :: t,\frac{Z\angle\angle op}{2} : t,\frac{X\angle\angle op}{2}$.

(*) By *Theorem* 3, *Chap.* 1, *of the Young Gentleman's Geometry.*

(†) By *Corol.* 2, *Theorem* 3, *Chap.* 1, *of the Young Gentleman's Geometry.*

(‖) By *Theorem* 5, *Chap.* 1. *of the Young Gentleman's Geometry.*

THEOREM IV.

On which is founded the Solution of plain obliquangular *Triangles, when, the three Sides being given, the Angles are ſought.*

Fig. 14. DB : DG : : DF : DE, *that is in Words*; The greateſt Side DB of any plain Triangle, is to the Sum DG of the other two Sides, as is the Difference DF of thoſe Sides, to that Segment DE of the greateſt Side, which being taken away, the Cathetus CA will biſect the remaining Segment EB of the greateſt Side.

Demonſtration. By *Prop.* 36, 3 *Euclid*, $DG \times DF = DTq = DB \times DE$. Wherefore, by *Prop.* 15, 6 *Euclid*, DB : DG : : DF : DE.

From the three laſt Theorems is deduced, *Tab.* II, or the Solution of plain *obliquangular* Triangles, in all the Variety of Caſes that can be propos'd. Nay, the ſaid Theorems may ſerve for the Reſolving of all plain Triangles whatever, *Rectangular* as well as Obliquangular. But foraſmuch as the firſt Theorem do's ſuffice to ſhew the Solution of plain rectangular Triangles, and that after a more eaſy Manner in ſome Caſes, hence the three laſt Theorems are wont to be reſtrain'd to the Solution only of plain obliquangular Triangles. And conſequently, *Tab.* II, is accommodated only to obliquangular Triangles. Of which Table the twelve firſt Caſes are founded on the 2d Theorem, the three next Caſes, (*viz.* 13th, 14th, and 15th,) on the 3d Theorem; and Caſe the 16th or laſt on the 4th and laſt Theorem. And thus much for the Solution of plain Triangles by Calculation.

CHAP. III.

Of the Solution of plain Triangles by Protraction.

1. Two Things *to be here taught.*

HERE are two Things to be ſhewn; 1*ſt*, How to *protract* or deſcribe any plain Triangle requir'd. 2*dly*, How to *reſolve* the ſaid Triangle, when it is protracted; *i. e.* how to find the Meaſure of the unknown Angles or Sides in the ſaid Triangle, when protracted.

2. *Firſt, how to* protract *any given* Side. *Fig.* 15.

Protraction is either of ſome Side, or of ſome Angle. A given Side is protracted by drawing a right Line BC, *Fig.* 15, taken off from the (ſimple or diagonal)

nal) Scale of equal Parts, at ſuch a Length, as to contain the ſame Number of equal Parts according to the Scale, as is the Number of Inches or Feet, *&c.* in the Side given, *viz.* 254.

3. *Secondly, how to* protract *any given* Angle.

A given Angle B=48 Degrees, is protracted, by (taking a Chord of 60 Degrees for your Ray, *i. e.* by) opening your Compaſſes to the Extent of 60 Degrees on your Scale of Chords, and then, one Foot being faſtened on one End B of the given Side BC, drawing with the other Foot the Arch CA; and on the ſaid Arch ſetting off from A to E, the Extent of 48 Degrees taken from your Scale of Chords; and after that drawing the right Line BD.

4. *A plain Triangle* how *to be deſcrib'd, when the* three Sides *are given, and no Angle.*

After this manner is any given Side and Angle to be protracted, and ſo any plain Triangle to be deſcrib'd, when either one Side and two Angles, or two Sides and one Angle are given. But, if the three Parts given be the three Sides; then the Triangle is to be deſcrib'd, as is ſhewn, *Chap.* 2, *Problem* 2, *Caſe* 1*ſt*, *or* 2*d*, *or* 3*d*, *of the Young Gentleman's Geometry.*

5. *How to find the Meaſure of a* Side not given.

The Triangle BCD, (*Fig.* 15,) being protracted, the Meaſure of any Side not given, is found, by applying the Extent thereof with your Compaſſes to your (ſimple or diagonal) Scale of equal Parts, and ſo finding how many ſuch equal

Parts

Parrs are contain'd in the ſaid Side. Which equal Parts are to be eſteem'd Inches, or Feet, or Yards, accordingly as the Meaſure of the given Side is denoted by Inches, or Feet, or Yards, *&c.* Thus, ſuppoſing BC to be 254 Feet long, CD will be 198 Feet, and BD 204 Feet.

6. *How to find the Meaſure of an* Angle not given.

In like Manner, the ſaid Triangle being protracted, the Meaſure of any Angle C or D not given, is found, by opening your Compaſs to the Extent of 60 Degrees on your Scale of Chords, and then fixing one Foot on the Point of the Angle ſought, and making an Arch from one Leg to the other of the ſaid Angle. The Extent of the Arch apply'd to your Scale of Chords, will ſhew the Degrees of the reſpective Angle. Thus, *Fig.* 15, the Extent of the Arch FG, ſhews C to be an Angle of 52 Degrees; and the Extent of the Arch EG, ſhews D to be an Angle of 80 Degrees.

7. *The Solution of plain Triangles by Protraction,* on what founded.

It remains to be obſerv'd, that the Solution of plain Triangles by Protraction, is founded on *Theorem* 9, *Chap.* 1, *of the Young Gentleman's Geometry.* Namely, becauſe the protracted Triangle is equiangular to the real Triangle, (*i. e.* the triangular Ground, or the like,) therefore, the Sides of that have the ſame Proportion one to the other, as have the

Sides of this; albeit thoſe are in a manner infinitely leſs than theſe.

8. *The Uſe of plain* Trigonometry *appears in taking* Heights *and* Diſtances, *&c.*

And thus having ſhewn, how to reſolve any plain Triangle, either by Calculation or Protraction; I proceed now to illuſtrate the great Uſefulneſs of plain *Trigonometry*, in taking *Heights* and *Diſtances*, as alſo in *Surveying* and *Fortification*.

CHAP. IV.

Of Taking the Altitude *or* Height *of an Object*, viz. *Tower*, *Tree*, &c.

I. *The* Height *of an Object, what.*

IT is to be remember'd, that (according to *Definition* 42, *Chap.* 1, *of the Young Gentleman's Geometry*.) the Altitude or Height of an Object, *viz.* Tower, Tree, and the (*) like, is meaſur'd by a Perpendicular from its Top to its Bottom. Thus, the Height of the Tower, *Fig.* 16, and of the Tree, *Fig.* 17, is denot-

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(*) For as to the Height of the Sun, or any other Celeſtial Light, that is computed by its Diſtance above the Horizon on a vertical Circle: Of which in *Aſtronomy*.

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ed by the Perpendicular CA; and ſo in all other ſuch Caſes through this Treatiſe.

3. *The* Symbols *made Uſe of in taking Heights.*

For the Line CA of Altitude, and the Line BA of Diſtance, (*viz.* between the Obſerver B, and the Foot of the Object A,) and the Line BC of Viſion do always conſtitute the three Sides of a rectangular Triangle ABC. Wherein the Height of the Object is the Cathetus or Perpendicular, and therefore, (according to the receiv'd Method of denoting the ſeveral Parts of a rectangular Triangle in *Trigonometry*,) is aptly denoted by CA. In like manner, the Diſtance of the Obſerver from the Object, making always the Baſis, is aptly denoted by BA; and the Line of Viſion, making always the Hypotenuſe, is aptly denoted by BC. And ſo as to the ſeveral Angles, A denotes the right Angle between the Line of Altitude and the Baſis, B the Angle between the Baſis and Hypotenuſe, which may be call'd, *the Angle of Altitude*, becauſe the Altitude of the Object is always either (†) its Sine or Tangent; and ſo C will denote the remaining Angle

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(†) Namely, if BA be taken for the Ray, then CA is the Tangent of B; but if BC be taken for the Ray, then CA is the Sine of B.

between the Lines of Viſion and Altitude.

3. *How to take* the Angle of Altitude.

The beſt Inſtrument for taking the Angle of Altitude is the Quadrant, thence commonly diſtinguiſh'd by the Name of *the Quadrant of Altitude*; by which it is done thus. Hold your Quadrant upright, ſo as the String may have Liberty to ſlip to either Edge, and move the Quadrant ſo held, 'till through the Sights you ſee the Top of the Object, whoſe Height you would take. Then the Degrees, intercepted between the Beginning of the Quadrant and the String, are the Degrees of the Angle of Altitude; namely, of the Altitude of the Object above your Eye. Wherefore, if you ſtand upright, when you take the Angle of Altitude, to the Altitude found by the ſaid Angle of Altitude, there muſt be always added the Height of your Eye above the Ground, to know the Altitude requir'd of the Object.

4. *An* acceſſible *and* inacceſſible *Height, what.*

If one may come to meaſure from the Place B of Obſervation, to the Foot A of the Object, (*i. e.* to the very Bottom of the Perpendicular CA,) then it is call'd an *acceſſible* Height. But, if any Thing hinders from coming to A the Foot of the Object, then it is call'd an *inacceſſible* Height.

PRO-

PROBLEM I.

To find an acceſſible *Height.*

5. *Firſt, by* Calculation. *Fig.* 16.

Meaſure your Line BA of Diſtance, and find the Meaſure of the Angle B by your Quadrant. Theſe two being known, CA is found by *Tab.* 1, *Caſe* 1, *viz.* R : tB : : BA : CA. For Inſtance: Suppoſe BA=347 Feet, and B=35 Degrees. Wherefore,

As the Ray	10,000000	
To the Logarithm of BA 347 Feet	2.540329	Add
So the artificial Tangent of B 35 Degr.	9.845227	
To (the Logarithm of the Side ſought CA 243 Feet very near.	12.385556	
	10,000000	Subſt.
	2.385556	Reſidue.

6. *Secondly, by* Protraction. *Fig.* 16.

If you would find the Height ſought CA by Protraction, work thus. Draw (according to *Chap.* 3, §. 2,) the Line of Diſtance BA=347 (equal Parts or) Feet. Then, (by *Chap.* 3, §. 3,) make the Angle B=35°, and the Angle A=90 Degrees, or a right Angle. Then draw the Sides BC and CA, 'till they meet in C. Apply CA to your diagonal Scale, and it will be equal to 243 (equal Parts thereof, or) Feet.

7. *Some* other Methods *of taking* acceſſible *Heights.*

To the Method of taking Heights by Protraction, may be referr'd the Method of taking Heights by a *Staff*, or a *Bowl of Water*, or the like. Foraſmuch as by Help of the Staff or Bowl of Water, (*&c.*) there is as it were protracted a Triangle, equiangular to the Triangle made by the three Lines of Viſion, of Diſtance, and of the Altitude ſought. Namely, in *Fig.* 17, or 18, the Triangle *bac*, is equiangular to the Triangle BAC, (as ſhall be ſhewn by and by,) and therefore, the Meaſure of the Sides *ba* and *ca* being known, as alſo of BA, thereby is found (according to the Rule of Proportion) CA the Altitude ſought. For, (according to *Theorem* 9, *Chap.* 1, *of the Young Gentleman's Geometry*,) *ba* : *ca* : : BA : CA.

8. *Acceſſible Heights may be taken by a* Staff *two Ways.*

Now the Way to find the Altitude of an Object by a Staff, is two-fold, either by the Staff and its Shade, when the Sun ſhines; or elſe by the Staff alone, at any Time, or whether the Sun ſhines or Not.

9. *To take an acceſſible Height by a* Staff *and its* Shadow. *Fig.* 17.

To find the Altitude of an Object by a Staff and its Shade, work thus. At B, the End of the Shadow caſt by the Top of the Object, ſet up your Staff *ca* perpendicularly, (as *Fig.* 17,) and mark the End *b* of the Shadow made by your Staff. For, as *ba* : *ca* ; ; BA : CA, *i. e.*

As the Length of the Staff's Shadow, is to the Height of the Staff; ſo is the Length of the Object's Shadow, to the Height of the Object. For Inſtance: Suppoſe your Staff *ca* to be three Foot long, or juſt a Yard, and its Shadow *ba* to be nine Foot long, and the Shadow BA of the Object to be 60 Foot long; then the Height of the Object will be twenty Foot. For 9 : 3 : : 60 : 20. This Method depends (as is afore ſaid) on *Theorem* 9, *Chap.* 1, *of my Geometry*, or) on the Triangles *bac*, and BAC being mutually equiangular. And that they are ſo, is thus ſhewn, *viz.* the Staff *ca* being erected perpendicularly, therefore, the Angle *a* is a right Angle, and ſo equal to A. Alſo, becauſe the (‖) Ray of the Sun, (or, which comes to the ſame, the Extremity of the ſhaded Air) *bc*, is always parallel to the other Ray BC, therefore, (by *Theorem* 3, *Chap.* 1, *of my Geometry*,) the Angle *b*=B, and conſequently, the Angle *c*=C; and ſo

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(‖) Although the Rays of the Sun, as proceeding from the Sun as their Center, are in Strictneſs, not parallel, yet by Reaſon of their immenſe Length or Diſtance from the Sun, wherein they concur, their Obliquity is not diſcernible in ſuch Caſes, but they may be eſteem'd as parallel; eſpecially as to ſuch ſmall Segments or Portions of them as are herein concern'd.

the Triangle *abc*, equiangular to the Triangle ABC.

10. *To take an acceſſible Height by a* Staff alone. *Fig.* 18.

If the Sun do's not ſhine, then you may nevertheleſs find the Height of the Object by your Staff alone, thus. Having ſet up (as afore) your Staff *ca* perpendicularly, go backward 'till you can ſee the top C of your Object, in a Line with the top *c* of your Staff, as is repreſented, *Fig.* 18, by the Line *b*C or BC, Then (*) *ba* : *ca* : : BA (or *b*A) : CA, that is, as the Diſtance *ba* of the Place *b*, where you ſaw the Top C of the Object, and the Top *c* of your Staff in one Line *bc* (or B*c*) from the Place *a* of your Staff, is to the Height *ca* of the Staff; ſo is the Diſtance of the former Place (*b* or) B from the Foot A of the Object, to the Height CA of the Object.

11. *To take an acceſſible Height by a* Diſh *or* Bowl of Water. *Fig.* 19.

If you would for Curioſity Sake know, how to find the Height of an Object by a Bowl or Diſh of Water, it is done thus. Go backward from the Bowl, 'till ſtanding upright, you can ſee the Top C of the Object in the Water. Then *ba* : *ca* : : BA : CA, *i. e.* as is the Diſtance *ba* of your

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(*) For here alſo *bca* and BCA are equiangular Triangles. For CA and *ca* being both Perpendiculars, are therefore Parallel. And conſequently, (by *Theor.* 4, *Chap.* 1, *of my Geometry*,) the Angle *c*=C, as well as *a*=A; and the Angle B or *b* is common to both Triangles.

your Station a from (†) the Bowl b, to your own Height ca as far as to your Eyes; ſo is the Diſtance BA of the Foot A of the Object, to the Height CA of the Object. For, according to that principal Theorem of Catoptricks, the Angle of Reflexion Pbc, is equal to the Angle of Incidence PBC. And therefore, the Angle abc ($=1$ Right$-Pbc=1$ Right$-$PBC) $=$ABC. And the Angle $A=a$, becauſe both Right; and therefore, the remaining Angles C and c are equal; and ſo the Triangles ABC and abc equiangular.

20. *To take an acceſſible Height by* Quadrant only. *Fig.* 20.

Laſtly, There is one Way more to take an acceſſible Height, which I ſhall here mention by Reaſon of its Eaſineſs and Expediteneſs, when it may be us'd. It is thus. Go towards or from your object CA, if you have Room, 'till the String of your Quadrant falls juſt on the 45th Degree. Then the Height CA of your Object, will be equal to BA the Diſtance between your Place B, and the Foot A of the Object. For the Angles B and C will be equal, (*viz.* each 45 Degrees,) and therefore, the Triangle

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(†) If you would be exact, your Diſtance, and the Diſtance of the Object muſt be both taken from the very Point of the Water, whereon you ſee the Top of the Object.

ABC will be an Iſoſceles, *i. e.* BA=CA, by *Theorem* 5, *Corol.* 2, *of the Young Gentleman's Geometry.*

PROBLEM II.

To find an inacceſſible *Height.*

13. By Calculation. *Fig.* 21. Take two Stations B and *b* lying in a direct Line with the Foot A of the Object. The Diſtance B*b* between theſe two Stations, with the two Lines of Viſion BC and *b*C, make an obliquangular Triangle BC*b*. All whoſe Angles are known, by taking the two Angles of Altitude CBA and C*b*A, in their reſpective Triangles BCA and *b*CA. For 180—Angle CBA=CB*b*; and 180—CB*b*+*b*=BC*b*. The three Angles of the Triangle *b*CB being thus known, and the Diſtance B*b* between the two Stations being meaſur'd, the Side BC is found by *Caſe* 11, *Tab.* II, (*viz.* sB : CD : : sD : BC. For, that is in Reſpect of the Notation of the ſeveral Sides of the Triangle BC*b*, *Fig.* 21,) sBC*b* : B*b* : : sC*b*B : BC. But now BC is alſo the Hypotenuſe of the rectangular Triangle ABC; and the Meaſure of BC being known, as alſo of the Angle CBA, (*viz.* CBA=180—CB*b*,) hence may be found CA the Height of

the Object, by *Caſe* 6, *Tab.* I, *viz.* R : sB : : BC : CA.

For Inſtance : I would know the Height of the Church-Steeple, *Fig.* 21, between A the Bottom of which, and *b* the Place where I am, runs a River, ſo that it is an *inacceſſible* Height. Wherefore, by my Quadrant, I take the Angle C*b*A of Altitude at my Station *b*, which I find to be 27 ½ Degrees. Then meaſuring in a ſtraight Line from *b* to B my ſecond Station, (which I find to be 92.7 Foot,) I take the Angle CBA of Altitude again at my ſecond Station B, and find it there to be 52 ½ Degrees. Hence it follows, that the Angle $CBb = 127\frac{1}{2}$ Degrees, (for $CBb = 180 - CBA$;) and alſo, that the Angle $BCb = 25$ Degrees, (for $BCb = 180 - : CBb + CbB : = 180 - 155$;) Having thus in the Triangle BC*b* the three Angles, and one Side B*b* given, thereby is found the Side BC, by *Caſe* 11, *Tab.* II, *Viz.*

As the Sine of BC*b* 25 D. 30 M.	9.633984
To the Log. of B*b* 92.7 Foot	1.967080
So the Sine of C*b*B 27 D. 30 M.	9.664406
	11.631486
To the Log. of BC ſomewhat above 99.4 f. *viz.* 100 f. very nearly	9.633984
	1.997502

Having thus found the Meaſure of BC, and having afore found the Angle CBA, thereby is found CA the Height ſought by *Caſe* 6. *Tab.* I. *viz.*

As the Ray	10.000000
To the Log. of BC 100	2.000000
So the Sine of CBA 52 D. 30 M.	9.899467
	11.899467
To the Log. of CA=793 and ſomewhat more, *viz.* 80.3 very nearly	10.000000
	1.899467

14. *To take an inacceſſible Height by* Protraction. *Fig.* 21.

If you would work by Protraction, you muſt proceed thus. Having (as afore) at the two Stations B and *b*, found the Angles of Altitude, *viz.* C*b*B and CBA, and meaſur'd the Length of B*b*, then draw a right Line B*b* of as many Parts on the Scale, as the Meaſure of B*b* is found to be of Feet (or Yards, *&c.*) At the two Points B and *b* make two Angles CBA and C*b*A equal to the Angles of Altitude taken by you at B and *b*. From C the Point, where CB and C*b* interſect or croſs one the other being drawn, let fall the Perpendicular CA to the Line of Diſtance B*b* extended, if need be, 'till it meets with CA. The Perpendicular CA apply'd to the Scale of equal Parts will ſhew the Number of Parts, *i. e.* of Feet or Yards, *&c.*

15. *To take an inacceſſible Height by a* Staff *and its.* Shadow. *Fig.* 22, & 23.

An inacceſſible Height may alſo be found by the Help of a Staff, and its Shade, thus. Set up the Staff *ca* perpendicularly, and mark the End *b* of its Shadow *Fig.* 23; and at the very ſame time mark the End B of the Shade of the inacceſſible Object CA *Fig.* 22. Then three or four Hours after mark again the End *d* of the Staff's Shadow, and alſo the End D of the Shadow of the inacceſſible Object. Then meaſure the Diſtance between the two mark'd Ends *b* and *d* of the Shade of the Staff, and alſo between the two mark'd Ends B and D of the Shade of the inacceſſible Object. As *bd* to *ca*, ſo BD to CA, *i. e.* As the Diſtance between the two different Ends of the Staff's Shadow, to the Height of the Staff; ſo will the Diſtance between the two different Ends of the Object's Shadow, be to the Height of the Object. For (by *Theor.* 9. *Chap.* 1. *of my Geom.*) *da* : *ca* :: DA : CA. Wherefore

fore *da*—(†) *ba* : *ca* : : DA—(†) BA : CA. *i. e.* *bd* : *ca* : : BD : CA.

To take an inacceſſible Height, when there is not] Room to take two *Stations on the Ground.* *Fig.* 24.

16. If it ſhould happen, that you have not Room to take two Stations, as *Fig.* 24. then an inacceſſible Height may be found thus. Firſt take the Arch CBA of Altitude on the Ground B; and then go up to the Top of the Houſe (or Tree) where you are, and there take the Angle CDB. Draw an indeterminate Line BA, and thereon at B erect the Perpendicular BD, of an equal Length with the Height of the Houſe DB, (which is ſuppos'd to be known,) and thereon at D make an Angle CDB equal to the Angle taken on the Top of the Houſe, and at B make an Angle CBA equal to the Angle of Altitude taken on the Ground. Then extend BC and DC 'till they meet in C. A Perpendicular CA, let fall from C upon the indeterminate Line BA, being apply'd to the Scale of equal Parts, will ſhew the Height of the Object CA.

(††) For as the Lines *da* and DA are proportional by the fore-mention'd Theorem, ſo will their Parts *ba* and BA; becauſe, the Shade of the Staff will be proportionably lengthened or ſhortened, as is the Shade of the Object.

P R O-

PROBLEM III.

To meaſure the Height of an Object, which ſtands on the Top of another Object.

I would know the Height of the Spire C*d* above the Tower A*a*. Find the whole Height CA (by *Prob.* 1. if A be acceſſible, as *Fig.* 24; if inacceſſible, as *Fig.* 25, then by *Probl.* 2.) Then find the Height A*d* (or *ca*) of the Tower alone (as afore by *Probl.* 1. or 2.) Then CA—A*d* (or *ca*) =C*d* the Height of the Spire. *Fig.* 25, & 26.

PROBLEM IV.

To find the Height of an Hill or Mountain.

This may be done in ſome Manner by *Probl.* 2. But becauſe the Tops of Hills or Mountains, if of any conſiderable Height, do appear higher than really they are, by reaſon of the Refraction of the Ray of Viſion; therefore there is another more exact Method to find the Height of Hills and Mountains, by the help of an Inſtrument called *the Brazen* T, from *Fig.* 27.

from its reſembling the Letter of that Name, as may be ſeen *Fig.* 27. For this Inſtrument being plac'd between two Staves (or Spikes, divided into a certain Number of Feet, and thoſe ſubdivided into Inches) thereby may be obſerv'd (at leaſt by the Help of ſlipping Marks, to be mov'd upwards or downwards) what Number of Feet and Inches the Hill riſes or the Aſcent increaſes at all the ſeveral Poſitions of the ſaid Staves, from the Bottom to the Top of the Hill or Mountain. And conſequently, by adding together the ſeveral Feet and Inches, which at the ſeveral Poſitions of the two Staves, have been obſerv'd to be contain'd, between the horizontal or level Lines, thence will ariſe the Sum of all the Feet and Inches from the Bottom to the Top of the Hill, and ſo the Height ſought. Thus the Height CA of the Hill or Mountain *Fig.* 27. is equal to the Sum of $ab+cd+ef+gh$. And this Method is called *Cultellation.*

CHAP.

C H A P. V.

Of Taking the Diſtance between two Objects.

1. *Two different general Caſes in taking Diſtances.* IN taking Diſtances (as well as Heights) there are in general two different Caſes. For either we may come to (*) *One*, or *Neither* of the Two Objects, whoſe Diſtance one from the other we would take.

2. *The Angle of Diſtance, what.* The Angle which is oppoſite to the Line of Diſtance (between the two Objects) may be call'd, the *Angle of Diſtance*, and is here denoted by the Letter D: Foraſmuch as the Triangles ariſing in taking Diſtances are generally obliquangular Triangles.

3. *How to take the Angle of Diſtance.* The moſt commodious Inſtrument for taking Angles of Diſtance is the *Theodolite* or *Circumferentor*, i. e. a Braſs Circle divided into 360 Degrees, and fitted with four

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(*) As for the third Caſe, *viz.* wherein *both* the Objects, whoſe Diſtance is requir'd, may be come at, that do's not ſtand in need of *Trigonometry* to find the Diſtance, becauſe it may be meaſur'd (without any more adoe) by a Chain or other long Meaſure.

four Sights. For the Sights being ſo mov'd, as that you can through two of them (lying in a ſtrait Line AB) ſee one, A, of the Objects, and through the other two (on the Line DE) ſee the other, E, of the Objects, the Angle ACE will be the Angle of Diſtance; whoſe Meaſure will be the Degrees intercepted between CA and CE; and are always equal to the Degrees between CD and CB, becauſe the Angles ACE and DCB are vertical Angles, and conſequently equal. Whence BCD as well as ACE may be eſteem'd the Angle of Diſtance.

See *Fig.* 40, of *Geometry.*

PROBLEM I.

To take the Diſtance between two Objects, when One *of the Objects is* acceſſible.

4. *By* Calculation. *Fig.* 28.

I would know the Diſtance of the Object B (*Fig.* 28.) from the Object C; one, B, of which Objects is acceſſible, but the other, C, is not. On one Side of B, I chooſe a Station D, at a (†) conſiderable Diſtance from B. The Line BC of Di-

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(†) *Note,* That the greater the Diſtance BD is between the acceſſible Object B, and the Station D, ſo much more exact will the Operation be.

ſtance between the two Objects B and C, and the Lines BD and CD of Diſtance between each Object and my Station, make an obliquangular Triangle BCD. Now the Angles CBD and BDC being found by the Theodolite, and conſequently the Angle DCB being known, (*viz.* DCB=180—CBD+BDC) and the Side BD being meaſur'd, hereby may be found BC the Diſtance requir'd between the two Objects B and C, by *Tab.* II, *Caſe* 9, *viz.* sC : BD : : sD : BC.

5. *An Example.* For Inſtance: Suppoſe BD, the Diſtance of my Station D from the acceſſible Object B, to be one hundred and four Yards; and the Angle BDC=86 Degr. and the Angle DBC=63 Degr. and conſequently the Angle BCD=31 Degr. It follows, according to the forementioned *Caſe* 9, *Tab.* II, that

As the Sine of C 31 Deg.	9.711839
To the Logarithm of BD 104 Yards	2.017033
So the Sine of D 86 Deg.	9.999404
	12.016437
To the Log. of BC 202 very nearly	9.711839
	2.304598

6. *By Protraction. Fig.* 28. If you would take the Diſtance by Protraction, you muſt work thus. Draw BD containing 104 equal Parts upon your

diagonal Scale, equal to the Number of Yards found upon meaſuring BD. And then at one End B deſcribe the Angle B equal to its Meaſure of 63 Degrees found by the Theodolite; and likewiſe at the other End D deſcribe the Angle D=86 Deg. as found by the Theodolite. Then draw the Lines BC and DC, 'till they meet in C, the Line BC apply'd to your diagonal Scale, will ſhew the Diſtance of the two Objects B and C, *viz.* about 202 Yards.

7. *By a* Chain *or* Pole *only.* *Fig.* 29.

If you have no Theodolite, or ſuch like Inſtrument by you, the Diſtance BC may be taken only by a Chain or Pole (or the like) thus. Meaſure with the Chain the Diſtance BD between the acceſſible Object B and your Station D; which your Station chooſe ſo in this Caſe, as that it may be (as near as you can gueſs) at an equal Diſtance with B from the inacceſſible Object C. Then in the Lines of Viſion DC and BC mark out any two Points *d* and *b*, and meaſure with the Chain the ſeveral Lines DB, B*b*, *bd*, *d*D, and *d*B. Then protract a Trapezium BD*db* of the ſame Sides; the two Sides B*b* and D*d* of which being produc'd, will meet in C, which will denote the Place of your inacceſſible Object. And conſequently the Line BC, being apply'd to the Scale of equal Parts, will thereon ſhew the Diſtance ſought. For by meaſuring and protracting the Sides of the Trapezium BD*db*, you do in effect find and protract the Angles B and D of the obliquangular Triangle BCD, as well as the Side BD of the ſaid Triangle. And therefore the protracted Triangle BCD is equiangular to the Triangle made by the Lines of Viſion at B and D, and the Line BD; and conſequently the Sides of the protracted Triangle are proportional to the Sides of the real Triangle, repreſented by the protracted one.

8. *To take the* Breadth of a River. *Fig.* 29.

By this laſt Method may the Breadth of a River be taken. For if you ſuppoſe BD to be one Bank of the River, and C to denote a Point of the Bank on the other Side of the River; then the Diſtance of the Banks or Breadth of the River will be equal to BC. Where it is to be noted, that in this Method the Trapezium BD*bd* may be taken or meaſur'd out, on either Side of BD, *viz.* either towards the inacceſſible Object C, or on the other Side of BD, as you have Room or moſt Conveniency.

9. *To take* the Breadth of a River, *or any ſuch like Diſtance, by* a Staff *and* a Square-rule. *Fig.* 30.

The ſame may be performed alſo after this Manner. Set up a Staff perpendicularly on the Bank where you are, and thereon place a ſquare Rule with its Angle downwards on the Head of the Staff. Move the ſquare Rule, 'till the Line BA of Viſion from B a Point in the oppoſite Bank of the River, falls in directly with the upper Edge of one Side of the ſquare Rule; and then from the Point C (where the upper Edges of the two Sides of the ſquare Rule meet) draw, along the upper Edge of the other Side, a String, or Rope, or Chain, 'till it comes in a ſtraight Line to the Ground at *b*. As (†) *b*A : CA :: CA : BA, *i. e.* As the Diſtance *b*A between the Point *b*, where the String came to the Ground, and the Foot A of your Staff, is to CA the Height of your Staff; ſo is the Height CA of your Staff to the Diſtance BA of A (the Foot of your Staff, or) the Bank where your Staff is, from B the other Bank. And after the ſame Manner may any other Diſtance be taken, where only one Object is inacceſſible.

10. *To take the Diſtance of an* Object of Height, *as of a Tower,* &c. *Fig.* 21, or 22, & 23.

If the inacceſſible Object be an Object of Height, *viz.* a Tower, or Tree, or the like, then having found (by the Problem for taking an inacceſſible Height) the Height CA of the ſaid Object, and its Angle B of Altitude, thereby may be found the Diſtance ſought BA by *Tab.* I, *Caſe* 2; *viz.* R : *t*C :: CA : BA. For the Angle B being known, thereby is the Angle C known; *viz.* C=90—B.

(†) Namely, by *Corol.* 1, *Theorem* 11, *of the Young Gentleman's Geometry.*

PRO-

PROBLEM II.

To take the Diſtance between two Objects, when both *are* inacceſſible.

11. *By* Calculation. *Fig.* 31.

Take your firſt Station D as you pleaſe; and on the Side of the former chooſe a ſecond Station *d*, ſo as D*d* may be parallel to BC as nearly as you can. Then with your Theodolite at D one of your Stations, take the Angles BDC and CD*d*, which together make the Angle BD*d*. Then at your other Station *d* take the Angles B*d*C and C*d*F, (the Mark F being ſet up in a right Line with your two Stations D and *d*) which together make the Angle B*d*F. Now in the Triangle BD*d* the Angles $BDd+DBd=BdF$. Wherefore the Meaſure of the Angle B*d*F being found by the Theodolite, $DBd=BdF-BDd$. And therefore the ſtationary Diſtance D*d* being meaſur'd, $sDBd : Dd :: sBDd : Bd$ by *Caſe* 12, *Tab.* II; *viz.* $sB : CD :: sC : BD$. In like manner in the Triangle C*d*D, the Angles $CDd+DCd=CdF$. Wherefore the Meaſure of C*d*F being found by the Theodolite, the Angle $DCd=CdF-CDd$. And therefore by *Caſe* 12, *Tab.* II, $sDCd : Dd : sCDd :$ C*d*, C*d*. Wherefore the Angle C*d*B of the Triangle BC*d* being found afore, and the Angle CB*d*=CD*d* found alſo afore, it follows by *Caſe* 12, *Tab.* II, that sCB*d* : C*d* : : sC*d*B : BC the Diſtance ſought.

12. *By* Protraction. *Fig.* 31. To take the like Diſtance by Protraction, you muſt work thus. Take (as afore) at your two Stations, D and *d*, the ſeveral Angles BDC and C*dd*, and C*d*B and B*d*D. Then having meaſur'd your ſtationary Diſtance D*d*, and protracted it, on one End D thereof protract its reſpective Angles BDC and CD*d*; and on the other End *d* its reſpective Angles C*d*B and B*d*D. Draw out the ſeveral Sides of the Angles meet reſpectively, two BD and B*d* in B, the other two, C*d* and CD, in B. The Diſtance BC apply'd to your Scale of equal Parts, will give you the Diſtance ſought.

PROBLEM III.

To take the Draught of a City, or Port, or the like.

Fig. 32, & 33. This is done after the ſame Manner as is taken the Diſtance between two Objects, when both are inacceſſible; it being no other than a Repetition of the ſaid Operation, according to the Variety of the remarkable Objects which you would delineate or deſcribe in the Draught. For Inſtance: Let A, B, C, D, E and F denote ſo many remarkable Buildings (*viz.* Churches, or Pillars, or other publick Edifices) in a City; or elſe let them denote ſo many Ships lying in a Port or Harbour. I take two Stations M and N at ſo conſiderable a Diſtance, as that the Line MN of the ſaid Diſtance may be long enough to ſerve conveniently for the Baſis of all the Triangles to be taken. Then at M placing the fixt Index of my Theodolite in a right Line with MN, I turn the moveable Index, as Occaſion requires; and ſo take in order the ſeveral Angles MNA, MNB, MNC, *&c.* and ſo to the laſt MNF. Then removing to my other Station N, and placing (as afore) the fixt Index of my Inſtrument in a Line with MN, I take the ſeveral Angles NMA, NMB, NMC, *&c.*

Having done this, I (†) protract the Line MN of Diſtance between my two Stations M and N, taking from my Scale of equal Parts the Line *mn* anſwerable to

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(†) Having the Baſis MN, and the two Angles at the Baſis in each Triangle, the other Sides in each Triangle may be found by *Calculation*; but this Method being tedious, therefore Protraction is generally made Uſe of in this Caſe.

MN. And then at the End *m* of the Line *mn*, I protract the Angles *mna*=MNA, *mnb*=MNB, *mnc*=MNC, *&c.* Likewiſe at the other End *n* of the Line *mn*, I protract the Angles *nma*=NMA, *nmb*=NMB, *nmc*=NMC, *&c.* The Legs of the ſeveral Angles being produced, will ſhew in the ſeveral Points of Interſection *a*, *b*, *c*, &c. the reſpective Places of the ſeveral Objects A, B, C (*&c*); and conſequently their reſpective Diſtances, both one from the other, and alſo from each of my Stations M and N; *viz.* the Extents *ab*, or *ac*, &c, or *bc*, or *bd*, &c. being apply'd to my Scale of equal Parts, give the Meaſure of the ſaid Diſtances.

PROBLEM IV.

To find the Horizontal Line or Length of an Hill or Mountain.

Fig. 34. On the Top of the Hill, at C, ſet up a Staff or Mark of an equal Height with your Eye (above the Ground) or with the Staff to which the Quadrant is faſtned at B the Bottom of the Hill. Then move the Quadrant 'till you ſee the Top of the (Staff or) Mark at C, whereby you'll take the Angle CBA. Then meaſure up the Side BC of the Hill. Being come up to C, meaſure the Level C*c* on the Top of the Hill. Then meaſure the other Side *bc* of the Hill, and take the Angle *cba*, as you did afore the Angle CBA. Having done this, you may find the Length of the Hill, either by Calculation or Protraction.

If you work by Calculation, then in the Triangle ABC, having the Angle (CBA or) B, and the Hypotenuſe BC, the Baſis BA is found by *Caſe* 5, *Tab.* I, *viz.* R : sC : : BC : CA. In like manner, in the Triangle *abc* having the Angle *b*, and the Hypotenuſe *bc*, the Baſis *ba* is found by *Caſe* 5, *Tab.* II.

If you work by Protraction, then having protracted the Hypotenuſe BC, and on one End B thereof protracted alſo the Angle (CBA or) B; from the End C of the Hypotenuſe let fall a Perpendicular CA upon the other Leg of the Angle B. The Extent BA will be the Baſis of the Triangle ABC. In like manner will be found *ba*, the Baſis of the other Triangle *abc*.

Having thus found (either by Calculation or Protraction) the Meaſure of the two Baſes BA and *ba*, theſe two added together, and alſo to the Length of the Level-Line C*c* on the Top of the Hill, will give the total Meaſure of the horizontal Line or Length of the whole Hill, Namely, Suppoſing BA=160 Yards or Chains, *&c.* and *ba*=182, and the Level-Line C*c*=122, the total Meaſure of the Length of the Hill will be 464. And thus much for taking of Diſtances. Proceed we next to Surveying.

CHAP. VI.

Of Surveying *or* Meaſuring *of* Land.

1. Surveying, *why eſteem'd as belonging to* Trigonometry.

THE *Surveying* or *Meaſuring* of *Land* is eſteem'd as belonging to Trigonometry, and ſo uſually taught in Treatiſes of Trigonometry, becauſe the Way formerly us'd to ſurvey, was by taking the Angles and Sides of the ſeveral Triangles, into which any Spot or Tract of Ground may be divided; and then protracting the ſaid Angles and Sides on Paper; and after that finding the Area or Content of the ſeveral Triangles ſo protracted.

2. *An Example of the* old *Method of Surveying.*

This Method is illuſtrated *Fig.* 35. wherein the ſeveral Lines AB, BC, CD, *&c.* repreſent the ſeveral Sides or Hedges of a Ground; and the ſmall Circle T repreſents the Place of the Theodolite.

lite. Which being there plac'd, by turning the moveable Index thereof as Occaſion requires, the ſeveral Angles ATB, BTC, CTD, *&c.* are taken. And then by meaſuring with a Chain (or the like) from T reſpectively to A, B, C (*&c.*) thereby is found the Length of the ſeveral Sides TA, TB, TC, TD, *&c.* of the ſeveral Triangles ATB, BTC, CTD, *&c.* And ſo by the Help of the Angles and Sides thus found, the other unknown Angles and Sides of the ſeveral Triangles may be found, (either by Calculation or Protraction ;) and ſo the ſeveral Triangles may be protracted, and conſequently the whole Ground, made up of the ſaid Triangles. The Ground being thus protracted, its Area or Content is found (as has been obſerv'd in the Uſe of *Theor.* 7, *Chap.* 1, *of the Young Gentleman's Geometry*) by letting fall a Perpendicular from any Angle in each Triangle to its oppoſite Side, and multiplying the ſaid oppoſite Side into half the Perpendicular. Thus the Content of the Triangle ATB may be found, by letting fall a Perpendicular from the Angle ABT to the Side AT, and multiplying the Side AT into half the ſaid Perpendicular, (or, which comes to the ſame, by multiplying half the Side AT into the whole Perpendicular.) And in like manner may be fonnd the Contents of the other ſeveral Triangles BTC, CTD *(&c.)* and conſequently of the whole Ground ABCDEF.

3. *A* better *Method of Surveying.* But now foraſmuch as the Finding of the Angles and Sides in each Triangle, into which any Ground may be divided, is only in order to protract the Triangles, and ſo to find the Contents of the ſaid Triangles when protracted; hence there is found out another and much more expedite and exact Way for finding the ſaid Contents, (without being at the Trouble, firſt to find the Angles and Sides of each Triangle, and then to protract them when found, *viz.)* by finding the Meaſure of the Perpendicular and its Baſis *in the Field* or *Ground it ſelf.* I ſhall therefore ſay no more of the old Method of Surveying, (which properly belongs to Trigonometry) but ſhall forthwith proceed to ſhew the other Method, as being much to be preferr'd before the old Method, for the Reaſons already mention'd. And this Method I ſhall illuſtrate, by ſhewing how to ſurvey thereby the ſame Ground ABCDEF.

4. *An Example. Fig.* 36. And this Method is illuſtrated *Fig.* 36. For being come into the ſaid Ground, after viewing it, I perceive it may be conveniently diſtinguiſh'd into two Trapezium's ABCD and ADEF. Wherefore ha-

ving ſet up (*) Marks at the ſeveral Angles or Corners of the Ground ABCDEF, the ſtrait Line AD (ſuppos'd to be drawn between the Angles A and D) will divide the Ground into the two Trapezium's aforemention'd. Then I (†) meaſure with my Chain from A to C for the Diagonal AC, whereby the Trapezium ABCD is diſtinguiſh'd into two Triangles ABC and ADC. And (either (‖) as I go along meaſuring the Diagonal AC, or elſe after I have meaſur'd it) I find the Perpendiculars PB and PD by the Inſtrument for that Purpoſe; which from its Uſe and Shape

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(*) Theſe need be no other than Sticks, with ſome white Thing (as linnen Rags or Paper) faſtened on their Tops.

(†) In order to meaſure aright the Diagonal AC, (or any other ſtraight Line or Side of your Ground,) with the Chain, you muſt take great Care, that you keep in a ſtraight Line (as you go meaſuring) from A to C. In order whereto, he that carries the End of the Chain, muſt take Care that he that carries the Beginning of it, is always (at leaſt that Hand of his which carries the Beginning of the Chain) directly between him and the mark C they are meaſuring to, every Time the Chain is laid down, And in order to prevent any Miſtake as to the *Number* of Chains, it is adviſable for him that goes firſt at the Head of every Chain's Length to thruſt or faſten a Stick into the Ground, to be taken up by him that carries the End of the Chain. And ſo at laſt the Number of Sticks will ſhew the Number of whole Chains.

(‖) It ſeems moſt adviſable to meaſure the whole Diagonal firſt, becauſe, hereby there is the leſs Danger of miſtaking the Length of the Diagonal.

may be call'd the (*) *Perpendicular-Top*. In like manner I meaſure from A to E for the Diagonal AE, which diſtinguiſhes the Trapezium ADEF into two Triangles ADE and AEF. And then by my Perpendicular-Top, I find (one after the other) the two Perpendiculars PD and PF, and meaſure them with my Chain. And thus, the outer Sides or Hedges AB, BC, CD, DE, EF, FA, being all of them ſtraight or right Lines, the Work is done in the Field; all that remains to be done, being only to multiply half the Perpendiculars into their reſpective Diagonals, in order to know the Area or Content of each Triangle or Trapezium; and ſo of the whole Ground: Which may be done at Home, the Numbers of the Meaſure

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(*) For this Inſtrument is beſt made in the Shape of a common Top, which Boys uſe to whip. It is beſt made of a dried Piece of Box or Pear-tree, that will bear three Inches, or three Inches and an half Diameter. This being turn'd flat on the upper Round, (with a Neck to fit to the Head of a Staff,) find the Center of the ſaid upper Round or circular Surface, and thereon draw two or three concentrical Circles, (as you ſee, *Fig.* 38,) divide the ſaid Circles exactly into four equal Parts, (as in *Fig.* 38,) and then, with a Whipſaw very thin, ſaw by the Marks *a*, *b*, *c*, *d*, the two Lines *ab* and *cd* at right Angles pretty Deep. Thus, your Inſtrument is made; only in order to uſe it, it muſt be ſet on the Head of a Staff, as has been above intimated. To which End it is to be made with an Hole at the Bottom to ſlip on upon the Head of a Staff.

of the ſeveral Diagonals and Perpendiculars being ſet down in Writing, as ſoon as taken.

5. *Of* Gunter's Chain, *and the Way of* Working by Numbers, *to find the Content of a Ground by the ſaid Chain.*

And here it muſt be ſhewn, how the Numbers, denoting the Number of whole Chains or of ſingle Links, are to be multiplied in order to find the Content. The Chain then here ſuppos'd to be made uſe of by the Surveyor is that, which from its Contriver goes by the Name of *Gunter's Chain*, and which is beſt contrived for Surveying. It contains four Statute-Poles or Perches, each Perch containing fifteen Feet and an half, or five Yards and an half: ſo that the whole Chain is ſixty-ſix Feet or twenty-two Yards long. The whole Chain is divided into an hundred equal Links, ſo that twenty-five Links are juſt a Pole or Perch. And for the more ready counting the Links, it is uſual to diſtinguiſh every Ten with a Braſs Plate, (or the like) ſo contriv'd as to ſhew, ſome way or other, whether it be the firſt, or ſecond, or third, &c. Length (*i. e.* the 10th, or 20th, or 30th, &c.) Link from either End; the 50th or Middle Link having a more remarkable Plate than the reſt.

In meaſuring any Line or Extent by this Chain, regard need be had only to whole Chains or whole Links; which are to be writ down with a ſeparating Note, (whether Full-point or Comma, or any other Mark) between the Chains and Links, (as is uſual to do between Integers and Decimals,) *viz.* 6.35 denotes 6 Chains and 35 Links. If the Links be under 10, a Cypher muſt be prefix'd, *viz.* 7.09 denotes 7 Chains and 9 Links.

The Numbers denoting the Chains and Links being ſet down, as has been directed; to find the Content (of an exact Square or other rectangular Parallelogram, you multiply (*) the Length by the Breadth; but it ſeldom hap'ning that Grounds are of ſuch a Shape, hence it is generally requiſite to diſtinguiſh your Ground into Trapeziums, as has been afore ſhewn, and then to find the Content) you multiply the Diagonal by (†) half the Perpendicular, (or (‖) the like) and from the Product cut off five Figures (accounting Cyphers for ſuch,) reckon'd from the right Hand, with a Daſh of

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(*) Agreeably to what has been taught in *Defin.* 41, *Chap.* 1, *of the Young Gentleman's Geometry.*

(†) Agreeably to what has been taught in the *Uſe of Theorem* 7, *Chap.* 1, *of the Young Gentleman's Geometry.*

(‖) Namely, the Product will be the ſame, whether you multiply the whole Diagonal (or Baſis) by Half the Perpendicular, or the whole Perpendicular by Half the Diagonal, or the whole Diagonal by the whole Perpendicular; and take Half the ſaid Product for the Product ſought.

your Pen: So that the Figures to the left Hand denote the Acres.

If the five Figures cut off to the right Hand were not all Cyphers, multiply them by 4; and from the Product cut off again five Figures towards the right Hand, and the reſt will denote Roods or Quarters of an Acre.

Laſtly, if among the five Figures of the laſt Product, cut off towards the right Hand, there be any Figures beſides Cyphers, multiply all the five Figures by 40. From the Product cut off again five Figures to the right Hand; and thoſe of the left Hand will denote ſquare Perches or Poles. I ſhall now illuſtrate the foregoing Rules by ſome Examples.

Suppoſe then in *Fig.* 36, the Diagonal AE to be juſt 7 Chains long, and the Perpendicular PF to be 2 Chains and 88 Links, and the other ſhort Perpendicular *p*D to be 60 Links. I (†) add the two Perpendiculars together, and the Sum of them makes 3 Chains and 48 Links.

(†) For this is the moſt expedite Way, hereby having ſav'd the Trouble of two diſtinct Multiplications, firſt of $\frac{1}{2}$ PF by 700, and then of $\frac{1}{2}$ pD.

Then the Half of the ſaid Sum of my Perpendiculars, *viz.* 174, I multiply by the whole of my Diagonal (‖) 700. I cut off the five Figures to the right Hand, and the remaining 1 denotes one Acre.

174
700
1|21800

Then I multiply the five Figures cut off by 4, and the Product, (*viz.* 21800×4=) 87200, not amounting to above five Figures, I perceive the Trapezium ADEF do's not contain a full Rood (or Quarter of an Acre) above the whole Acre found afore.

Therefore I multiply again the ſecond Product 87200 by 40; and cutting off again the five Figures to the right Hand in this third Product, the two remaining Figures 34 denote ſo many ſquare Perches or Poles. Which wants almoſt ſix ſquare Perches of a Rood, or Quarter of an Acre, this containing 40 ſquare Perches. For a Statute-Acre contains 160 ſquare Statute-Perches.

87200
40
34|88000

(‖) I chooſe my Diagonal for the Multiplier, becauſe it being 700, I need multiply only by the Figure 7, and to the Product thereof add the two Cyphers.

Upon the Whole therefore I find, that the Trapezium ABEF contains one Acre, and a Quarter of an Acre over, wanting ſix ſquare Perches. I proceed then to find the Content of the other Trapezium ABCD; whoſe Diameter AC ſuppoſe to be 5 Chains and 15 Links; the Perpendicular PB to be 1 Chain and 61 Links; and the other Perpendicular PD to be 1 Chain and 89 Links. Wherefore I multiply the Diagonal 5.15 by Half the Sum of the two Perpendiculars, *viz.* 175; and the Product not ariſing to above five Figures, I perceive that the ſaid Trapezium does not contain a Whole Acre.

$$\begin{array}{r} 515 \\ 175 \\ \hline 2575 \\ 3605 \\ 515 \\ \hline 90125 \\ \hline \end{array}$$

Then I multiply the Product found by 4; and from the ſecond Product cutting off five Figures to the right Hand, there remains the Figure 3, which denotes the Contents of the Trapezium to be 3 Roods or three Quarters of an Acre, and ſomewhat more.

$$\begin{array}{r} 90125 \\ 4 \\ \hline 3|60500 \\ \hline \end{array}$$

I proceed therefore to find what more it is, which I do by multiplying the 5 Figures cut off by 40. From this third Product I cut off again the five Figures to the right Hand, and the remaining 24 denote ſo many ſquare Perches;

$$\begin{array}{r} 60500 \\ 40 \\ \hline 24|20000 \end{array}$$

Perches; which is a little above Half a Quarter of an Acre. So that upon the Whole I find the Trapezium ABCD to contain 3 Roods and a little (*viz.* 4 ſquare Perches) above half a Rood.

In the laſt Place then, by adding the Contents of the two Trapeziums ABCD and ADEF together, I find the whole Ground ABCDEF to contain one Acre, three Roods, and fifty-eight ſquare Perches: Which ſquare Perches amounting to a Rood more, and eighteen ſquare Perches over, therefore the Content of the ſaid Ground is in all, (when expreſs'd after the more proper Manner) two Acres, and eighteen odd ſquare Perches.

Acres	Roods	Sq. Per.
1	00	34
0	03	24
1	3	58, that is,
2	0	18

After the ſame Manner may the Content of the Ground ABCDEFGHIKL, repreſented *Fig.* 37, be found. Namely, firſt, ſet out in it as large a Trapezium ABGL as you can; and find the Content of the ſaid Trapezium, by multiplying Half the Diagonal, AG into the Whole Sum of the two Perpendiculars PB and PL. Then find the Content of the Triangle BFG by multiplying its Baſis

BG into Half the Perpendicular PF. Then find the Content of the Nook CDE by diſtinguiſhing it into as many Triangles (*) as you ſee requiſite, *viz.* CD*c*, D*cd*, and *dc*E; and finding the Content of each Triangle, as you did of the Triangle BFG. And in like manner is the Content of the other two Nooks GHI and IKL to be found. And then at laſt, the ſeveral Contents of the ſeveral Parts of the ſaid Ground being added all together, will give the Content of the Whole Ground. And after this Method may any Piece of Land be ſurvey'd, the ſeveral Caſes that can happen in meaſuring the Sides or Hedges of any Ground being repreſented in *Fig.* 37.

6. *Of* Laying *or* Setting out *a Piece of Land requir'd.*

Hitherto it has been ſhewn, how to ſurvey or meaſure a Piece of Land *already ſet* or *laid out* within its reſpective Bounds. It may be of uſe to obſerve here next, how to *ſet* or *lay out* a Piece of Land or Ground of ſuch a Meaſure, as ſhall be requir'd, or containing ſuch or ſuch a Number of Acres, *&c.*

(*) Namely, by this Method circular Nooks may be meaſur'd as exactly as by any other; at leaſt ſo exactly, as that what is wanting of Exactneſs, ſhall be ſo little as to be altogether inconſiderable. But it muſt be noted, the more Triangles ſuch circular Nooks or Windings are divided into, the nearer you'll come to the exact Meaſure of it.

7. *A* Statute-Acre, *what.* In order hereto, it is to be known in the firſt Place, that an Acre according to Statute-Law does contain one hundred and ſixty ſquare Statute-Poles or Perches; each ſuch Pole or Perch containing (as has been above obſerv'd) fifteen Feet and an Half, or five Yards and an Half.

Such being the Content of an Acre, it follows, that all rectangular Pieces of Ground, any of whoſe contiguous Sides are of any of the two Lengths ſet oppoſite hereto, will contain juſt an Acre. Whence it is obvious, how a Ground of a ſingle Acre may be laid out, if there be Room to make its contiguous Sides perpendicular one to the other, *viz.* by making the two contiguous Sides of ſome of the two Lengths ſet together above. Hence alſo it is obvious, that Grounds which have very different Sides, may yet have the very ſame Content.

$$\begin{array}{c}\text{Perches}\\ \left.\begin{array}{ccc}80 & \times & 2\\ 40 & \times & 4\\ 32 & \times & 5\\ 20 & \times & 8\\ 16 & \times & 10\end{array}\right\}\begin{array}{l}\text{Square Perches}\\ =160=1\text{ Acre;}\end{array}\\ \text{\&c.}\end{array}$$

If there be not Conveniency to lay out the Acre of Ground in a rectangular Shape, then it may be laid out it in any other Shape or Figure, by conſidering what Proportions are to be taken, to make the Content of the ſaid Figure juſt equal to 160 equal Perches. For Inſtance; if I can lay out the Acre in a Triangular Shape; then the Baſe and Perpendicular of the ſaid Triangle muſt have ſome of the oppoſite (or ſuch like) Proportions one to the other; foraſmuch as the Baſis multiplied into Half the Perpendicular (or *vice verſa*) gives the Content of a Triangle.

Baſis	Perpend.		
160 &	2		160 × 1
80 &	4		80 × 2
64 &	5	for	$64 \times 2\frac{1}{2} = 160$
40 &	8		40 × 4
32 &	10		32 × 5
(&c.)			&c.
Perpend.	Baſis		

The Way, how to lay out an Acre of Ground in a triangular Shape, being known, thereby may be known the Way to lay out an Acre of Ground in any multangular Figure; foraſmuch as all Polygons may be conſtituted by adjoining together ſeveral Triangles. And it being thus known how to lay out a *ſingle Acre* of Ground in any Shape or Figure; thence may be known how to lay out Grounds of *more Acres than one* in any Shape, by proportionably encreaſing the Lengths of the reſpective Parts. And thus I have taken notice of ſo much of Surveying, as ſeems requiſite to the Deſign of this Treatiſe.

CHAP. VII.

Of Fortification.

1. *A* Fort, *what.* BY a *Fort* or *Fortreſs* is ſignify'd a Place *fortify'd*, i. e. made ſtrong by the Art of Military Architecture, or Fortification.

2. *A* Rampart, *what.* The principal Part of a Fort, is that which is called the *Rampart* or *Rampire*, being a Wall of a good Height and Breadth, compos'd chiefly of Earth, and encompaſſing the Place fortify'd. It is repreſented *Fig.* 39, by DEWXYZ.

3. *A* Bulwark *or* Baſtion, *what.* The *Bulwark* or *Baſtion* of a Rampart is that Part of it, which runs farther out than the reſt, ending in an Angle. It is repreſented *Fig.* 39. by IFEGH, *&c.*

4. *The* Face, Gorge, Shoulder, *and* Flank *of a Baſtion, what.* The ſeveral Parts of a Baſtion are its *Face* or *Front* FE; its Gorge (or Neck) IH; its Shoulder F; and its *Flank* (*or* Wing) FI; which, according to the new Method of the *French*, is not built in a ſtrait Line, but rounding, as is repreſented in ſome of the other Baſtions, by the Prick'd-circular Lines about the Flank.

5. *A* Curtain, *what.* The Part of the Rampart between two Baſtions is called the *Curtain* KI, which joyns together the two Baſtions IFEGH and KLDMN. More-

6. *The* Side of the outer *and* inner Polygon, *&c.* *what.*

Moreover, foraſmuch as (according to the Rules of Fortification) every Rampart is either a (*) Polygon, or at leaſt a Tetragon; hence the Line DE is called *the Side of the outer Polygon*; BG *the Side of the inner Polygon*; AC *the Semidiameter* of the *inner* Polygon; AE the *Semidiameter* of the *outer* Polygon; *p*A the *Cathetus* of the *inner* Polygon; PA the *Cathetus* of the *outer* Polygon; P*p* the *Diſtance of the Polygons.*

7. *The* Gorge-Line, Head-Line, *&c.* *what.*

Beſides which there are wont to be peculiarly diſtinguiſh'd alſo theſe ſeveral Lines, *viz.* the *Gorge-line* IC; the *Head-Line* CE; the (†) *Longeſt Line of Defence* KE, the *Shorteſt Line of Defence* *k*E.

8. *Of the principal* Angles *in Fortification.*

By the foremention'd Lines and Parts of the Rampire are conſtituted ſeveral Angles, whereof the Chief are theſe; *viz.* BAC the *Angle of the Center*; BCA or CBA the *Angle of the Polygon*; FEG the *Angle of the Baſtion*, otherwiſe called the *Diamond Point*, and the *Flanked Angle*; DOE the *outer Flanking Angle*; F*k*I the

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(*) The Reaſon of this Rule of Fortification depends upon the due Proportion there ought to be between the ſeveral Parts of the Rampart. And hence, according to the ſaid Rules, a regular Polygon is to be preferr'd before an Irregular. The Rampart, *Fig.* 39, is a regular Hexagon.

(†) See *Sect.* 30, 31, 32, of this Chapter.

inner Flanking Angle; FCE the *Front-angle*, or Angle forming the Face; FCI the *Flank-angle*, or Angle forming the Flank; CEF *the Head-line Angle*, &c.

9. *How Fortification* belongs to Trigonometry. It is alſo obvious, that by the foremention'd Lines are made ſeveral plain Triangles, *viz.* ABC, ADE, APD, APE, A*p*B, A*p*C; *p*FI, *k*FI, FIC, FCE, *&c.* Hence any three Parts of each of the ſaid Triangles (except the (‖) three Angles) being known, the other three unknown may be found by Trigonometry, as has been afore ſhewn. Such as would have particular Illuſtrations by Examples, may conſult ſuch Treatiſes as are profeſſedly written of Fortification. Thoſe young Gentlemen, for whoſe Uſe this Treatiſe is eſpecially deſign'd, being ſuch as are not likely to concern themſelves in the practical Part of Fortification, it ſeems abundantly ſufficient to my Deſign, to have thus ſhewn in general how Fortification depends upon Trigonometry.

10. *The Explication of* other *Terms of Fortification.* However being thus led, by (the Subject of this Treatiſe) Trigonometry, to take notice of the forementioned Parts and Terms of Fortification, becauſe it may be of good Uſe, in order to make

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(‖) The Reaſon of this Exception is largely given, *Chap.* 2. §. 1, of this Trigonometrical Treatiſe.

young Gentlemen underſtand, in a competent meaſure, Relations given of Sieges, I ſhall therefore here add the Explication of ſuch other Parts and Terms of Fortification, as are of principal Note and Uſe, and ſo moſt frequently occur in the Accounts of Sieges.

11. *A* Parapet, *what.* A *Parapet* then is (properly) a Work rais'd on the Rampart, behind which the Soldiers ſtand, and where the Cannon is plac'd for the Defence of the Fort. As in *Fig.* 51 and 52, *ab* denotes the Breadth of the Rampart at its Baſis or Bottom, ſo *dg* denotes the Breadth of the Parapet at its Bottom, or where it is rais'd on the Rampart.

12. *A* Banquet, *what.* A *Banquet* is no other than a Foot-pace at the Bottom of a Parapet, upon which the Soldiers ſtand up to fire into the Ditch, or upon the Covert-way beyond the Ditch. Some Parapets have only one Foot-pace, as is repreſented by *de*, *Fig.* 51. But it is the more commodious to have two, one for the taller Soldiers, and another (ſomewhat above the former) for the ſhorter, as is repreſented between *d* and *e*, *Fig.* 52.

13. *A* Fauſſe-bray, *what.* According to the old Way of Fortification, there is erected between the Ramparts and the Ditch, a Work called the *Fauſſe-braye*, or *Falſ-braye*, being a ſmaller Sort of a Rampart, having a Parapet,

and running round the whole main Rampart of the Fort. It is repreſented *Fig*, 51, by *xyz*. But the *French* omit this Work now-a-days in their Fortification, leaving between the Rampart and the Ditch only a Space about three or four Foot wide, to receive the Earth which falls from the Parapet. This Space they call the *Berme*. See *Fig*. 52. Wherein, as alſo *Fig*. 51, *klmn* denote the Ditch.

14. *The* Covert-way, *what.* On the outer-ſide of the Ditch is the *Covert-way*, being a Way or Walk (round the out-ſide of the Ditch) cover'd or defended by the Glacis. It is repreſented *Fig*. 51 and 52, by *np*.

15. *The* Glacis, *what.* The *Glacis* ſerves as a Parapet to the Covert-way, and loſes it ſelf inſenſibly in the Field. Hence the Largeſt are eſteem'd the Beſt, becauſe they loſe themſelves more inſenſibly than ſhorter ones. It is denoted *Fig*. 51 and 52, by *prs*.

16. *The* Counterſcarp, *what.* The *Counterſcarp* is properly the Slope *nm* of the Ditch on its Out-ſide, as being oppoſite to the *Scarp* or Slope *kl* of the Ditch on its Inſide. But by this Term now-a-days is generally underſtood the Covert-way with its Parapet.

17. *Of the* additional *Works of Fortification.* Beſides the Works hitherto ſpoken of, and which are requiſite to all Fortifications, there are alſo other *additional* Works contrived by Maſters of Military Architec-

ture, for to further fortify the ſeveral Parts of Fortification already deſcrib'd. And ſuch are *Half-Moons*, *Horn-works*, *Crown-works*, *Star-works*, *Ravelins*, *Tenailles*, &c. Of which the four former take their Names from their Shape. They will all be better apprehended by their reſpective Draughts, than by verbal Deſcriptions.

18. *A* Tenaille, *what.*

I begin with the *Tenaille*; of which there are three Sorts, repreſented *Fig.* 40, 41, and 42. They are placed in the Ditch, and before the Curtains of the Rampart. They are ſaid to be contriv'd by the *French* inſtead of the *Fauſſe-braye.*

The Tenaille, *Fig.* 41, is diſtinguiſh'd by the Name of the *ſingle* Tenaille; and that *Fig.* 42, by the Name of the *double* Tenaille.

19. *A* Ravelin, *what.*

A *Ravelin* is repreſented *Fig.* 43; being a ſmall triangular Work. It is generally rais'd alſo before ſome Curtain, either of the main Rampart, as *Fig.* 43, and 46, or of ſome Out-work, as the Ravelin, *Fig.* 44. before the Curtain of the Horn-work, *Fig.* 47, or elſe before ſome other Part analagous to a Curtain, as the Ravelin, *Fig.* 45, before the ſingle Tenaille, *Fig.* 41.

20. *An* Half-Moon, *what.*

An *Half-Moon* (*Fig.* 53.) is generally confounded with a Ravelin, its Difference being principally (if not only) this, that its Gorge *df* is an Arch in Shape of the Concave Part of an Half-Moon, and it is placed overagainſt Z, the Point of a Baſtion to cover it; whereas a Ravelin conſiſts of two ſtraight Demigorges, as *de ef*, *Fig.* 46, and is placed overagainſt ſome Curtain, as is afore obſerv'd.

21. *An* Horn-work, *what.* An *Horn-work* is repreſented *Fig.* 47. The Fore-part of it conſiſts of a Curtain between two Half Baſtions, which run out like Horns, whence it takes its Denomination. It is placed either before a Curtain or a Baſtion.

22. *A* Crown-work, *what.* A *Crown-work* is repreſented *Fig.* 48. It is ſo called, becauſe the Fore-part of it reſembles a Crown. It is uſually made before an Horn-work, to keep the Enemy at a Diſtance. It is alſo placed immediately before a Curtain or Baſtion of the Rampart.

23. *A* Star-work, *what.* A *Star* is a Work with ſeveral Faces, which flank one the other, as *Fig.* 49.

24. *A* Redoubt, *what.* A *Redoubt* is a ſmall ſquare Fort, or a Guard-houſe, having no Defence but in Front. It is uſually deſigned for maintaining the Lines of Circumvallation, or Countervallation. In watery Places they are often made of Maſon's Work. It is repreſented *Fig.* 50.

25. Out-works, *what.* All the forementioned Works, which lie without the Rampart of the Forts, are in general call'd the *Out-works.*

26. *A* Battery, *what.*

A *Battery* is a Place rais'd whereon to plant the great Cannon, in order to batter or play upon the Place beſieg'd.

27. Cavalliers, *what.*

Cavaliers are Works rais'd on the Parapet of a Rampart, whereon to plant Cannon in order to ſcour the Field, and to oppoſe any Work rais'd by the Beſiegers, which commands the Place beſieg'd.

28. Faſcins, *what.*

Faſcins are a Sort of Faggots, made to throw into the Ditch, where there is much Water, in order to make the Paſſage over to the Wall or Rampart of the Place beſieg'd, more eaſie.

29. Gabions, *what.*

Gabions are Baskets filled with Earth, and uſually placed upon Batteries, and Parapets, that have ſuffer'd very much, and alſo before other Places, to ſecure them from the Enemies Shot. Leſſer Gabions are call'd *Corbeilles.*

30. *A* Gallery, *what.*

A *Gallery* is a made Way or Walk, cover'd with Earth or Turf, and upheld with Planks. They are made in the Ditch already fill'd with Faſcins, to the end the Miners may approach ſafe to the Baſtion.

31. *Line of Defence, what.*

The *Line of Defence* is that, which is repreſented by the Diſcharge of the ſmall Shot towards the Face of a Baſtion. It is diſtinguiſh'd into the *Longeſt* and *Shorteſt*, otherwiſe called *Fichant* and *Raſant.*

32. *Line of Defence* Fichant, *what.*

The *Line of Defence Fichant* (or *Longeſt Line of Defence*) is the Line KE, ſo called, becauſe the Bullets or Shot, which paſs along this Line, may fix on the Face of the oppoſite Baſtion.

33. *Line of Defence* Razant, *what.*

The *Line of Defence Raſant* (or the *Shorteſt Line of Defence*) is the Line *k*E, drawn from the Face of the Baſtion, to that Point *k*, of the adjoining Curtain, where the Face of the ſaid Baſtion begins to be diſcovered. It is ſo call'd, becauſe the Shot, that paſſes along the ſaid Line, only raſes the Face of the ſaid Baſtion.

34. *A* Lodgment, *what.*

A *Lodgment* is a Work caſt up in a dangerous Poſt won by Attack, to ſecure the Beſiegers againſt the Enemies Fire. It is made of any Materials, that are capable of making Reſiſtance.

35. *To* Nail up a Cannon, *what.*

To *nail up a Cannon*, is to drive a Nail (or the like) into its Touch-hole.

36. *To* Sap, *what.*

To *Sap*, is to dig deep into the Earth of the Covert-way and Glacis in the Form of a Trench. The Earth dug out ſerves for a Security on the Right and Left, and covers above, the Soldiers (or others) in the Trench againſt the Enemies Fire-works, by the help of Hurdles laden with the ſaid Earth.

Military *Trenches* are of the ſame Kind with common Trenches, only larger, being uſually from ſix to ſeven Foot in Depth, and from eight to ten Foot in Breadth. They are made by the Beſiegers, to approach more ſecurely the Place beſieged; whence they are otherwiſe called the *Lines of Approaches*, or ſometimes *the Approaches*. And they are therefore ſo carried on, as not to be in View of the Enemy, or preſently and eaſily diſcoverable by the Enemy or Beſieg'd. 37. Trenches, *what.*

Lines of *Circumvallation* are Trenches made by the Beſiegers about their Camp: as well to hinder the Relief of the Beſieged, as to ſtop Deſerters from their own Army. They are guarded with a Parapet. 38. *Lines of* Circumvallation, *what.*

Lines of *Countervallation* are Trenches which the Beſiegers make to ſecure themſelves from the Sallies of the Beſieg'd. They are alſo guarded with a Parapet. 39. *Lines of* Countervallation, *what.*

Lines of *Communication* are Trenches made from one Work to another by the Beſiegers, for the better holding Communication one with the other, and helping one the other, in caſe of an Attack by the Enemy, in any of their Works. 40. *Lines of* Communication, *what.*

A *Retrenchment* is a Work made by the Beſieg'd to ſecure themſelves, and ſo to enable them to hold out ſome time longer 41. *A* Retrenchment, *what.*

ger againſt the Enemy, who is ſo far advanc'd as to be lodg'd on the Rampart. It has either a good Parapet, or inſtead thereof Gabions. And thus I have explain'd the more uſual Terms of Fortification, and ſuch as more frequently occur in Relations of Sieges.

CHAP. VIII.

Of the Tables of Logarithms, *and* Artificial Sines *and* Tangents.

1. *The Method of the Tables of* artificial Sines *and* Tangents, *adjoin'd to this Treatiſe.*

THE Tables of Artificial Sines and Tangents belonging properly to Trigonometry, they are therefore here adjoin'd to the End of this Treatiſe. They are ſo contriv'd, by placing the Sines and Coſines by the Side one of the other, and likewiſe the Tangents and Cotangents, that each Page ſhews the Sine and Coſine of two Angles, one whereof is ſet down on the Top of the Pages, the other (being the Complement of the former to 99) at the Bottom of the Page. Thus the Page (or Pages,) that hath Degree 2 at the Top, hath Degree 87 at the Bottom. And as the Sines and Coſines, Tangents and Cotangents belonging to the Degrees ſpecified at the Top, are reſpectively ſhewn by the reſpective Words ſet at the Top of the ſeveral Columns in each Page; ſo the Sines and Coſines, *&c.* belonging to the Degrees ſpecified at the Bottom, are reſpectively ſhewn by the reſpective Words ſet at the Bottom of the ſeveral Columns in each Page.

The Minutes between each two Degrees are ſet down on the Sides of the Pages, thoſe appertaining to the Degrees at the Top increaſing downwards; the other appertaining to the Degrees at the Bottom increaſing upwards. And on the Side of each Minute ſtands its reſpective Sine and Coſine, Tangent or Cotangent.

2. *The Table of* Logarithms, *why adjoin'd alſo to this Treatiſe.*

And, although Logarithms are of Uſe, in other Parts of Mathematicks as well as in Trigonometry, yet becauſe they muſt always be uſed with Artificial Sines and Tangents; I have therefore judg'd this the moſt proper Place alſo for the Table of Logarithms belonging to my Mathematical Treatiſes: of which I need ſay no more here, the Uſe of the ſaid Table of Logarithms having been already explain'd, in the Appendix to the *Young Gentleman's Arithmetick.*

Trigonom. Plate 1.

Fig. 1.

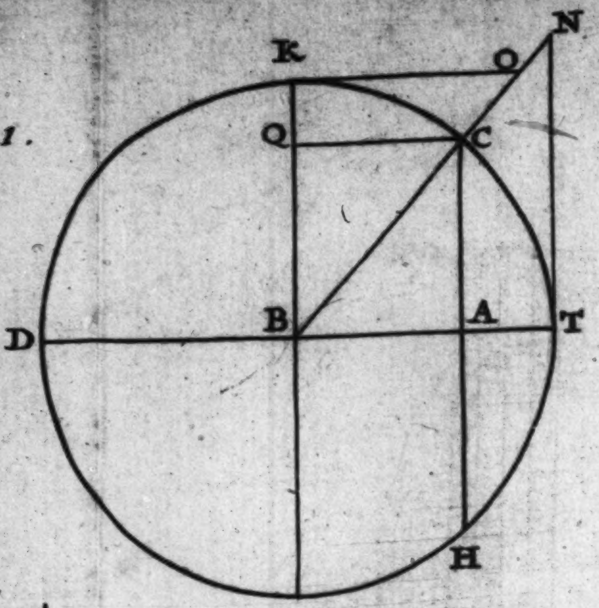


Fig. 2.

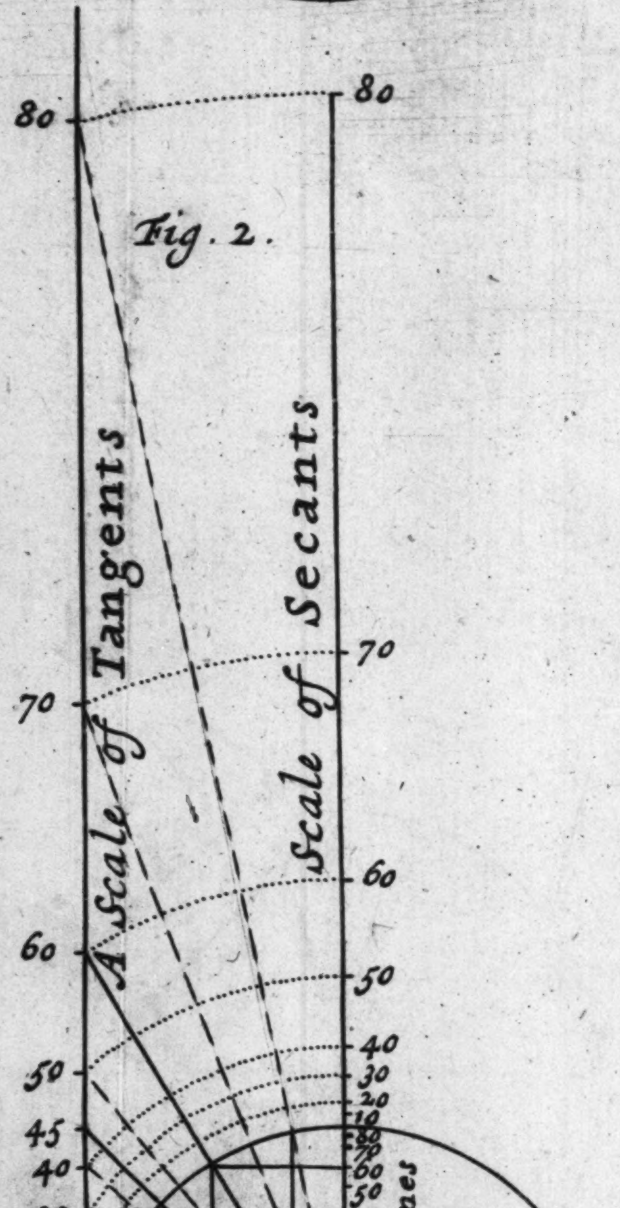


Fig. 2.

Fig. 3.

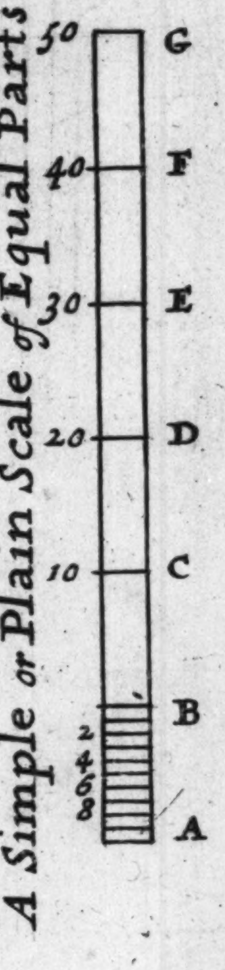


Fig. 4.

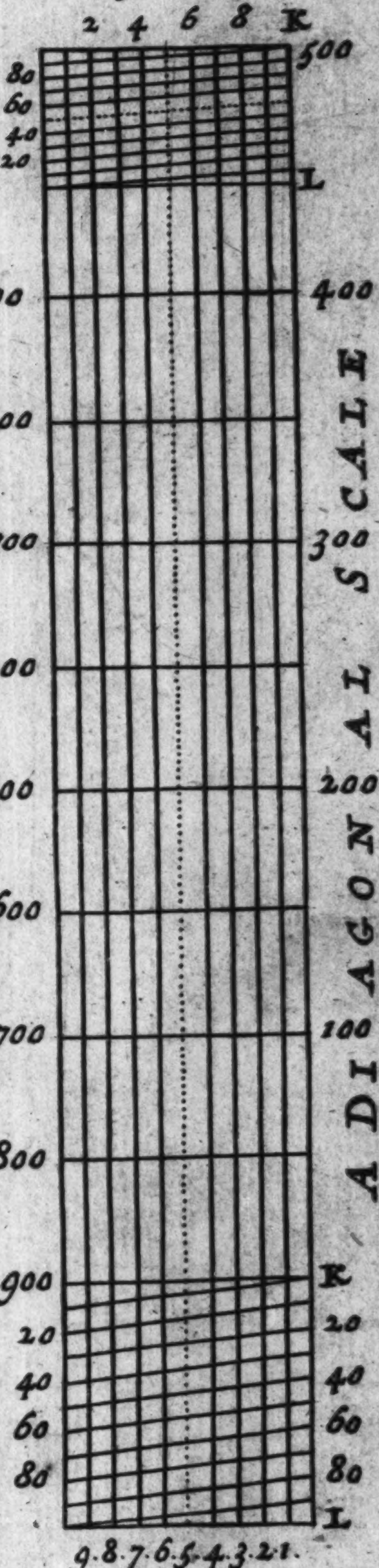


Fig. 5.

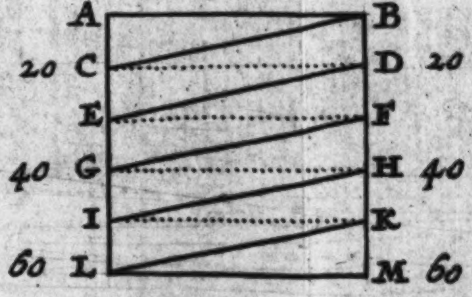
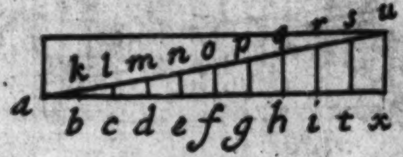


Fig. 6



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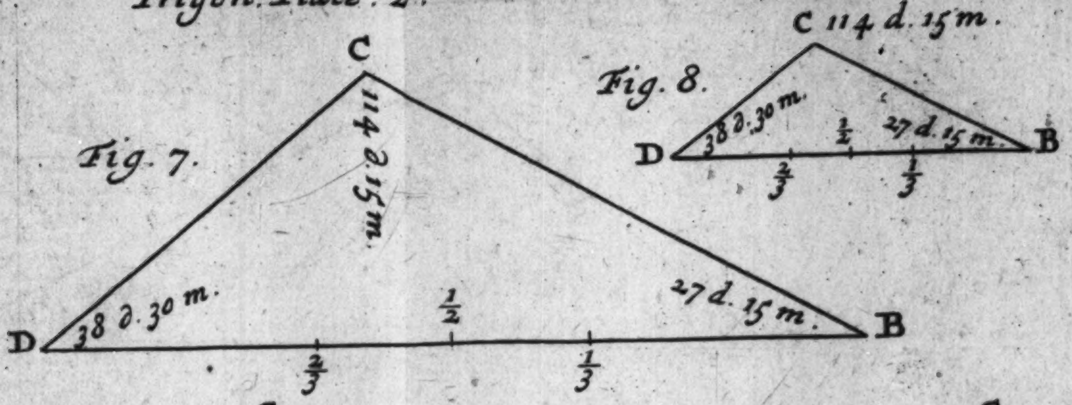


Fig. 8.

Fig. 9.

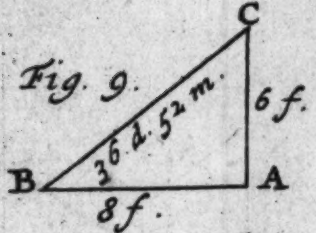


Fig. 10

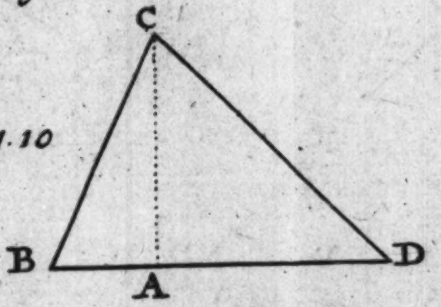


Fig. 11.

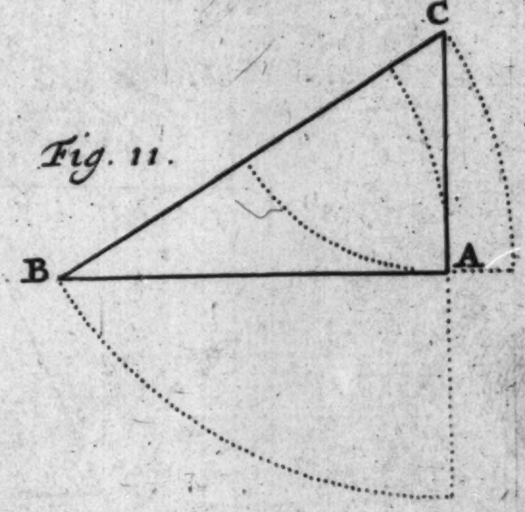
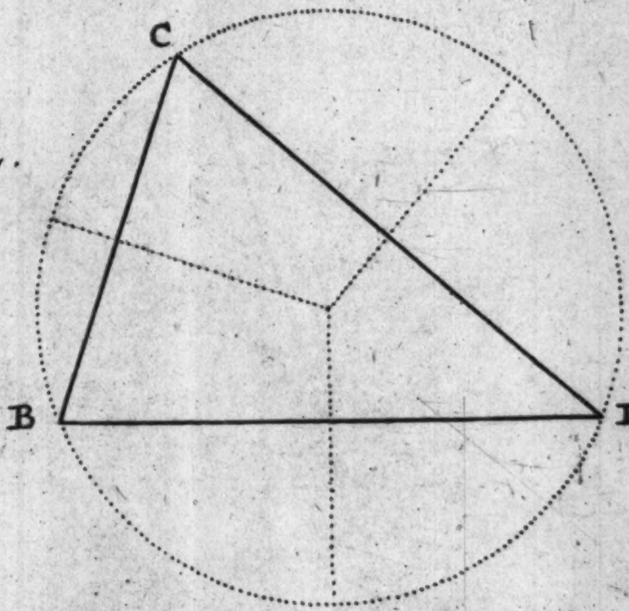


Fig. 12.



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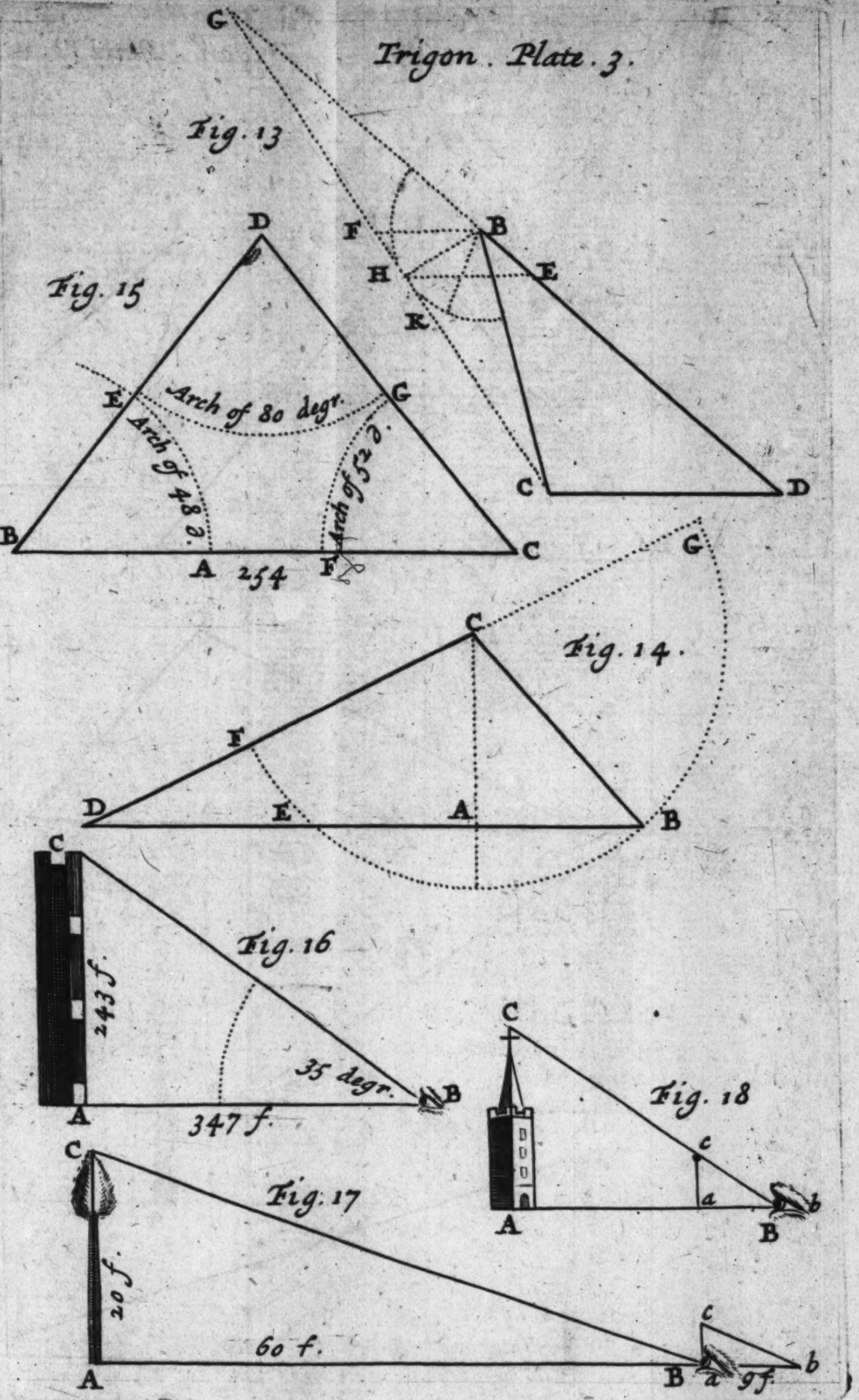

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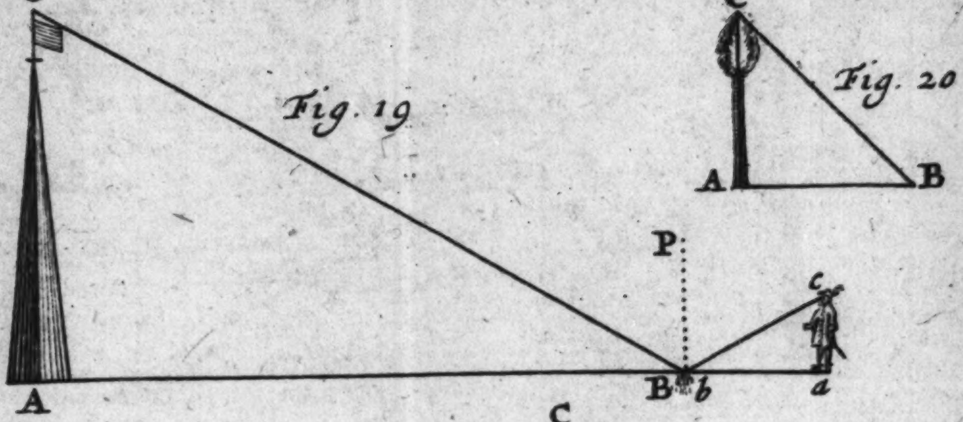
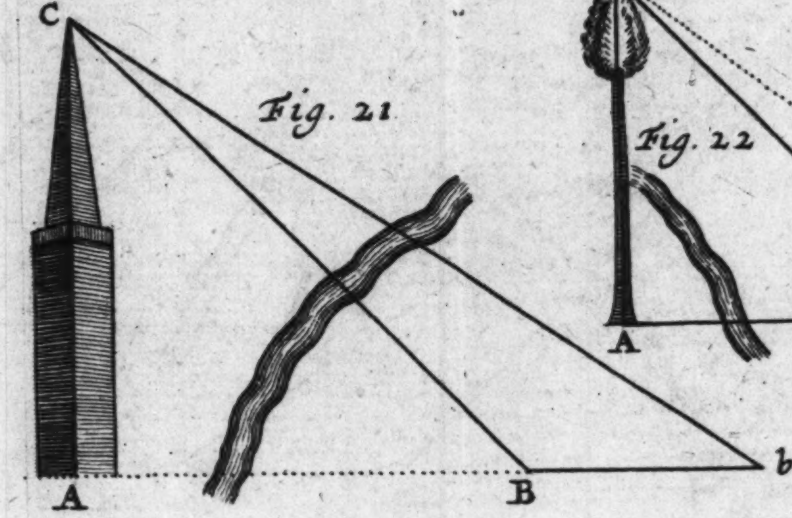


Fig. 19

Fig. 20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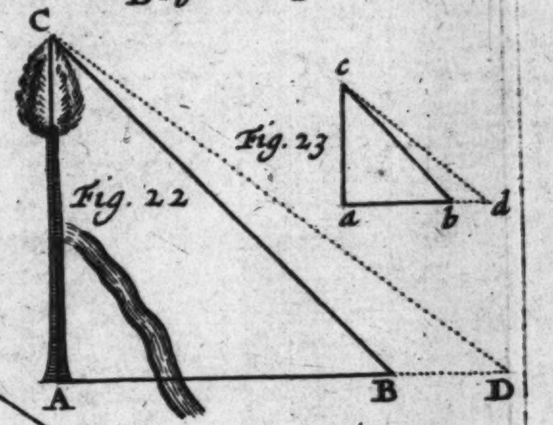
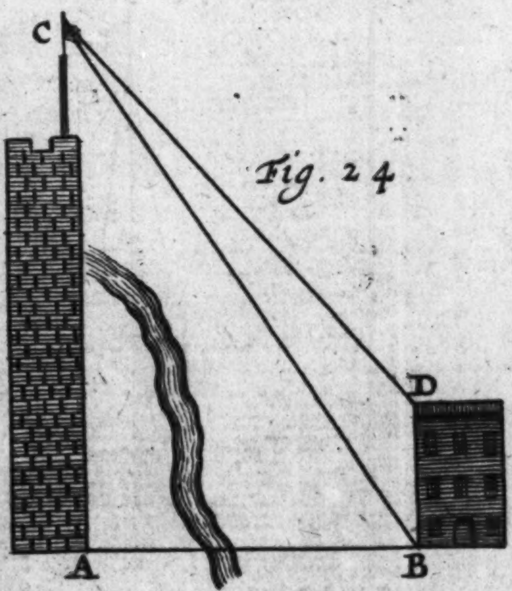


Fig. 22

Fig. 23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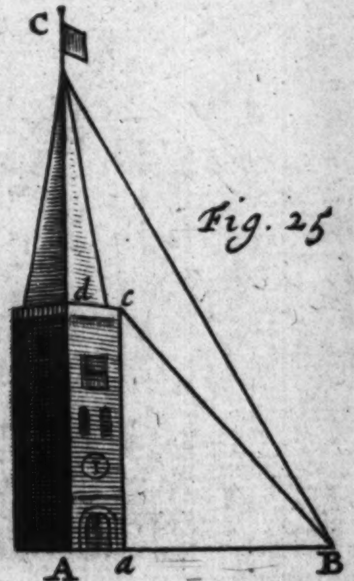
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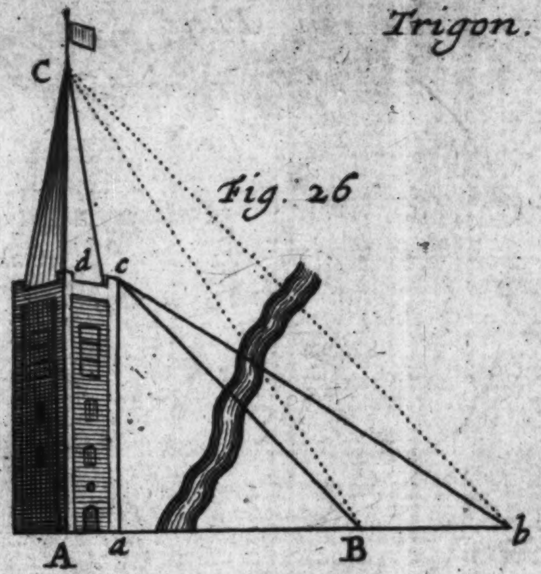
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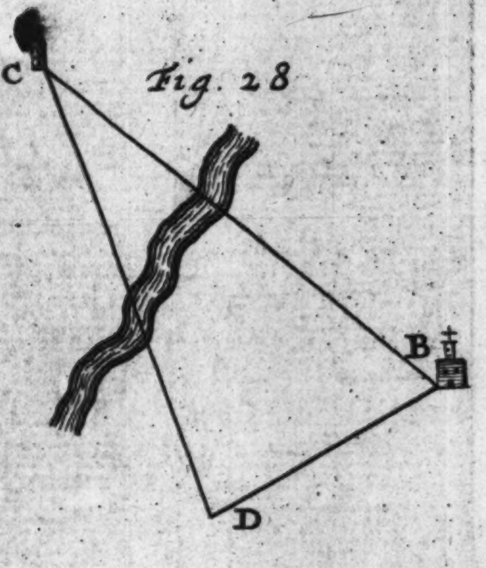
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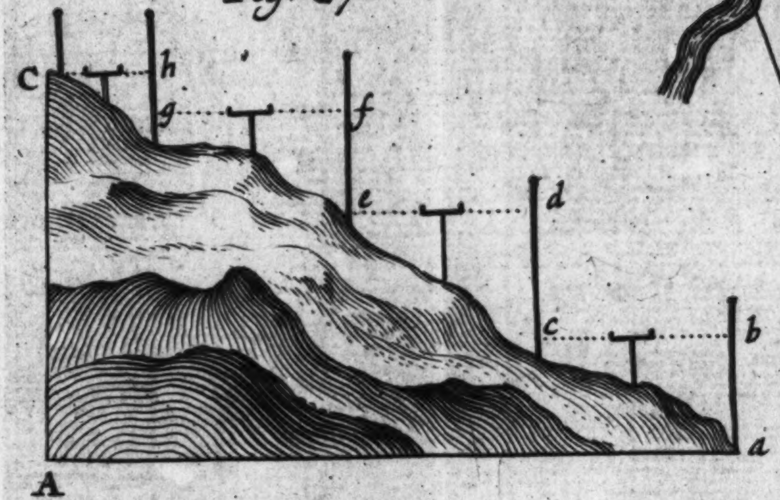


Fig. 27

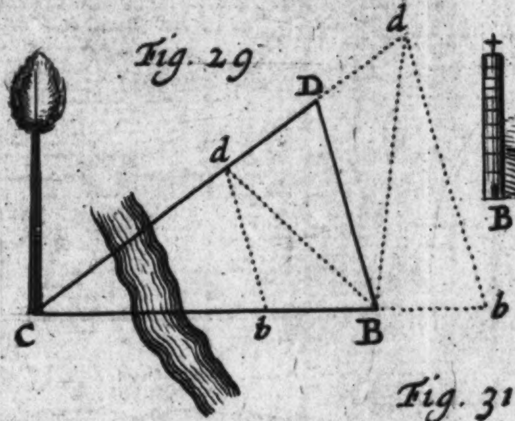


Fig. 29

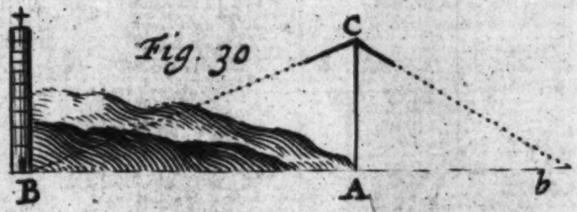


Fig. 30

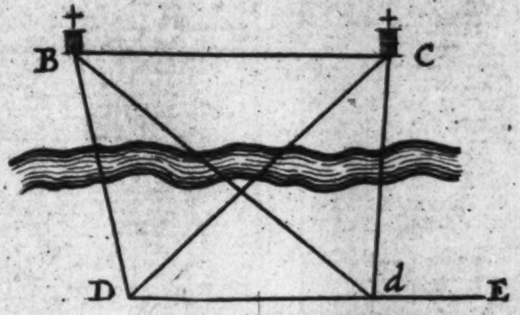
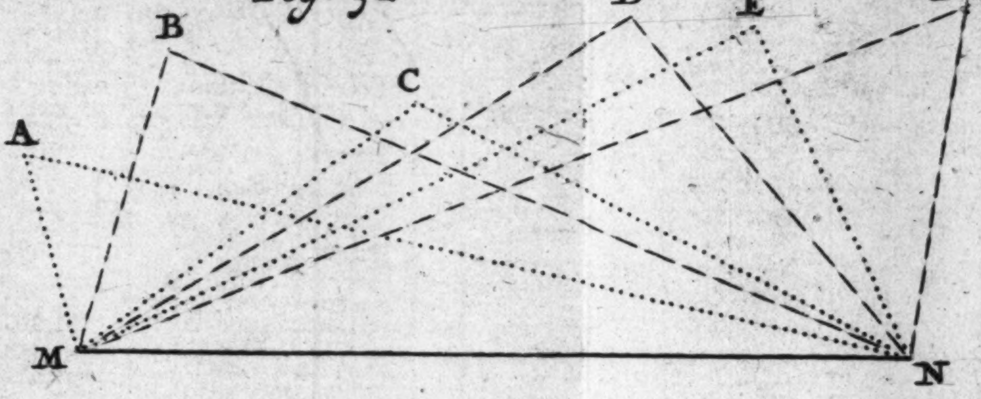


Fig. 31

Trigon. Plate. 6.

Fig. 32



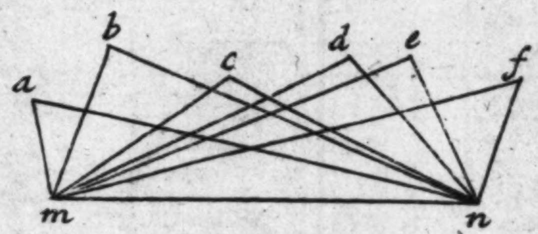


Fig. 33

Fig. 34

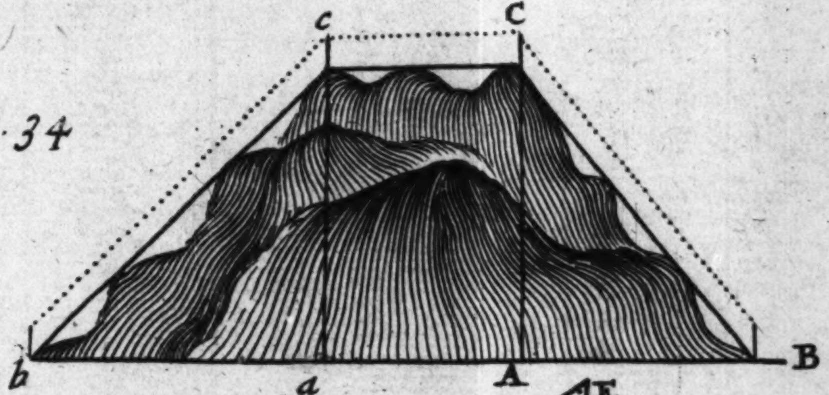
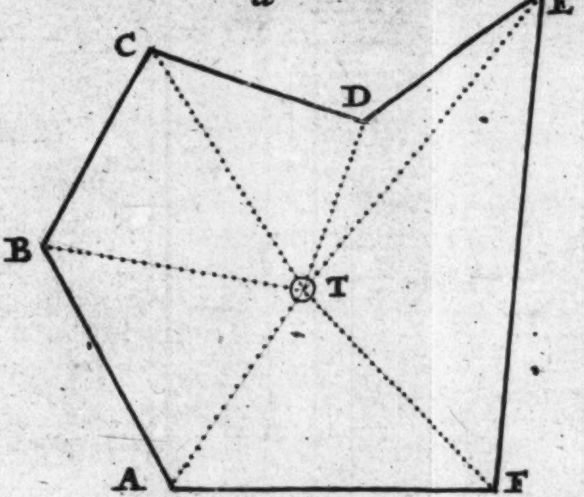


Fig. 35



Trigon. Plate 7.

Fig. 36

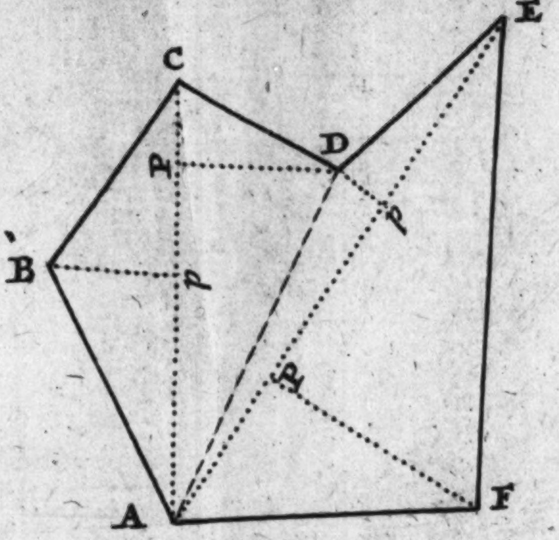


Fig. 37

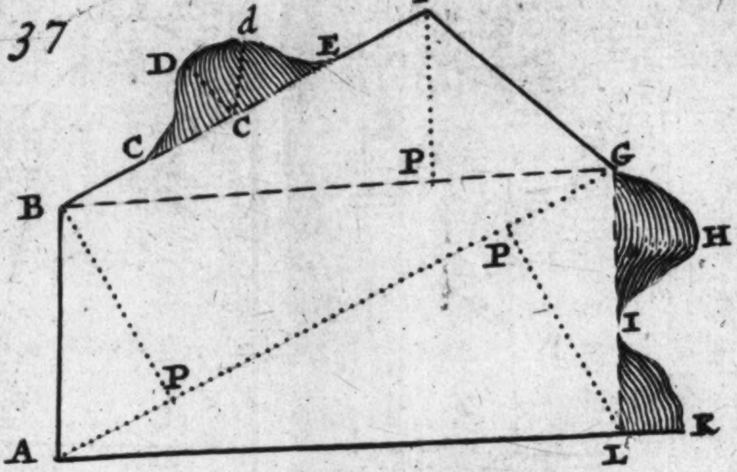
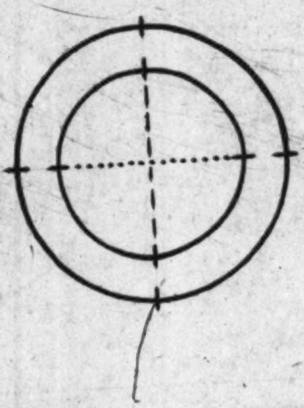


Fig. 38



Trigonom. Plate 8

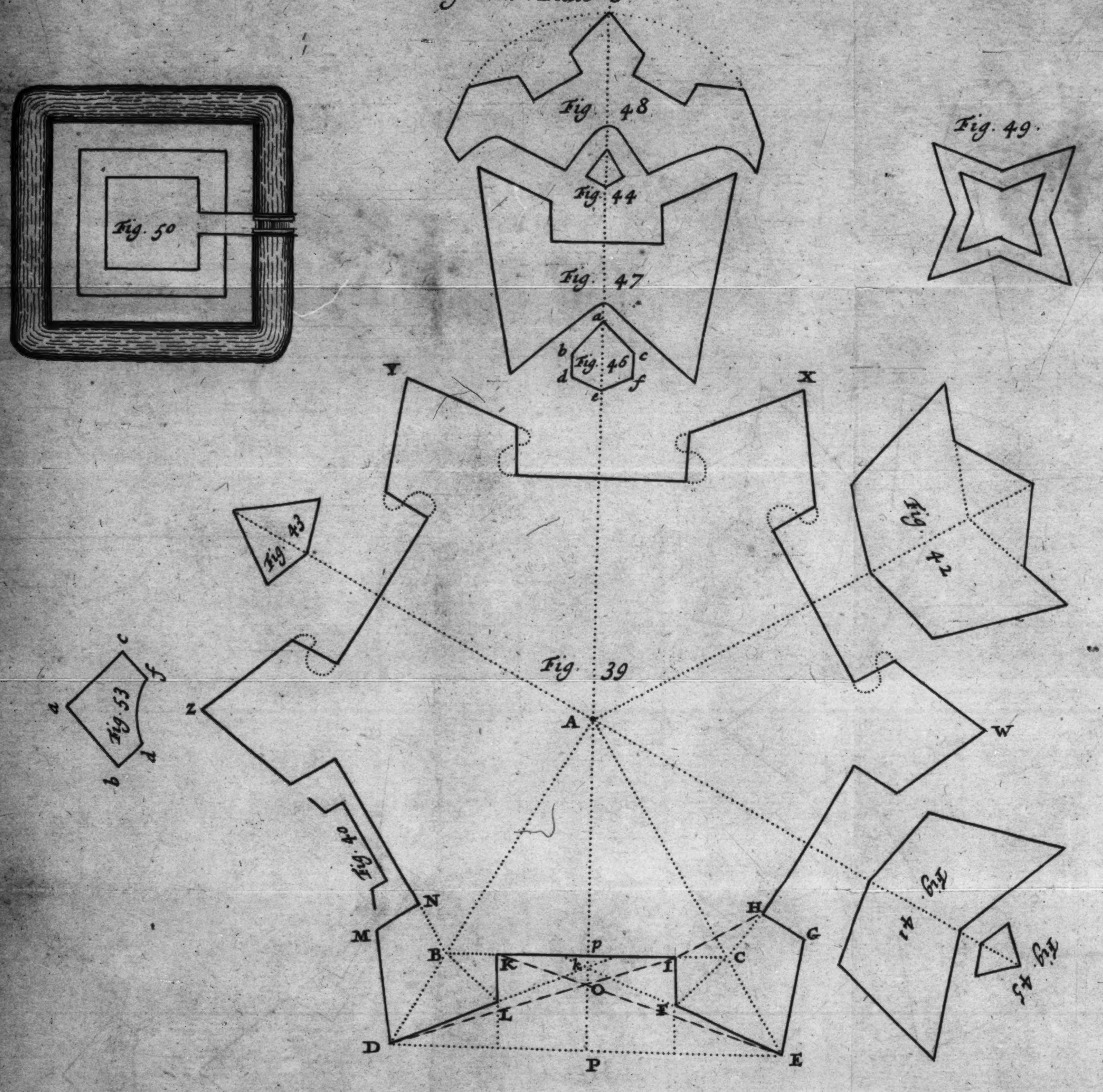


Fig. 51.

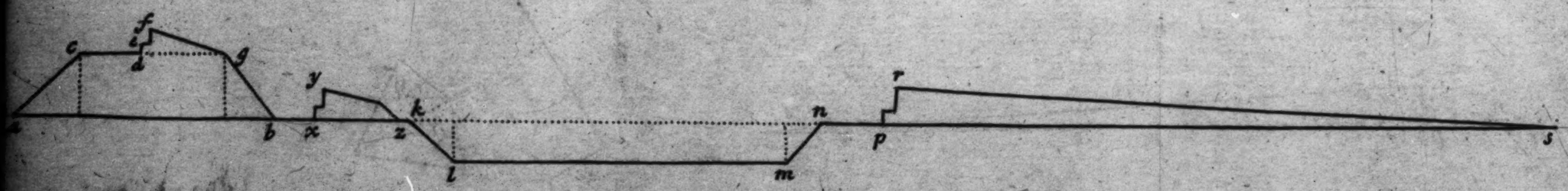
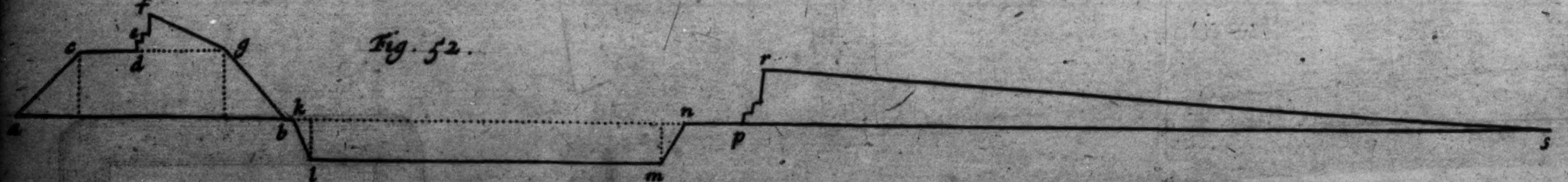


Fig. 52.



all the Cutts to be folded out

A
TABLE
OF
Logarithm's,
From One to Ten Thouſand

N	
1	0.
2	0.
3	0.
4	0.
5	0.
6	0.
7	0.
8	0.
9	0.
10	1.
11	1.
12	1.
13	1.
14	1.
15	1.
16	1.
17	1.
18	1.
19	1.
20	1.
21	1.
22	1.
23	1.
24	1.
25	1.
26	1.
27	1.
28	1.
29	1.
30	1.
31	1.
32	1.
33	1.

N	Log.	N	Log.	N	Log.
1	0.000000	34	1.531479	67	1.826075
2	0.301030	35	1.544068	68	1.832509
3	0.477121	36	1.556303	69	1.838849
4	0.602060	37	1.568202	70	1.845098
5	0.698970	38	1.579783	71	1.851258
6	0.778151	39	1.591064	72	1.857332
7	0.845098	40	1.602060	73	1.863323
8	0.903090	41	1.612784	74	1.869232
9	0.954242	42	1.623249	75	1.875061
10	1.000000	43	1.633468	76	1.880813
11	1.041393	44	1.643452	77	1.886491
12	1.079181	45	1.653212	78	1.892094
13	1.113943	46	1.662758	79	1.897627
14	1.146128	47	1.672098	80	1.903090
15	1.176091	48	1.681241	81	1.908485
16	1.204120	49	1.690196	82	1.913814
17	1.230449	50	1.698970	83	1.919078
18	1.255272	51	1.707570	84	1.924279
19	1.278753	52	1.716003	85	1.929419
20	1.301030	53	1.724276	86	1.934498
21	1.322219	54	1.732394	87	1.939519
22	1.342422	55	1.740362	88	1.944482
23	1.361728	56	1.748188	89	1.949390
24	1.380211	57	1.755875	90	1.954242
25	1.397940	58	2.763428	91	1.959041
26	1.414973	59	1.770852	92	1.963788
27	1.431364	60	1.778151	93	1.968483
28	1.447158	61	1.785330	94	1.973128
29	1.462398	62	1.792391	95	1.977723
30	1.477121	63	1.799340	96	1.982271
31	1.491361	64	1.806180	97	1.986772
32	1.505150	65	1.812913	98	1.991226
33	1.518514	66	1.819544	99	1.995635

N	0	1	2	3	4
100	000000	000434	000868	001301	001734
101	004321	004751	005181	005609	006038
102	008600	009026	009451	009876	010299
103	012837	013259	013679	014100	014521
104	017033	017451	017868	018284	018700
105	021189	021603	022016	022428	022841
106	025306	025715	026125	026533	026942
107	029384	029789	030195	030599	031004
108	033424	033826	034227	034628	035029
109	037426	037825	038223	038620	039017
110	041393	041787	042182	042576	042969
111	045323	045714	046105	046495	046885
112	049218	049606	049993	050379	050766
113	053078	053463	053846	054229	054613
114	056905	057286	057666	058046	058426
115	060698	061075	061452	061829	062206
116	064458	064832	065206	065579	065953
117	068186	068557	068928	069298	069668
118	071882	072249	072617	072985	073352
119	075547	075912	076276	076640	077004
120	079181	079543	079904	080266	080526
121	082785	083144	083503	083861	084219
122	086359	086716	087071	087426	087781
123	089905	090258	090610	090963	091315
124	093422	093772	094122	094471	094820
125	096910	097257	097604	097951	098298
126	100371	100715	101059	101403	101747
127	103804	104146	104487	104828	105169
128	107209	107549	107888	108227	108565
129	110589	110926	111263	111599	111934

5	6	7	8	9	D
002166	002598	003029	003461	003891	432
006466	006894	007321	007748	008174	428
010724	011147	011570	011993	012415	424
014940	015359	015779	016197	016616	419
019116	019532	019947	020361	020775	416
023252	023664	024075	024486	024896	412
027349	027757	028164	028571	028978	408
031408	031812	032216	032619	033021	404
035429	035829	036229	036629	037028	400
039414	039811	0402[illegible]	040602	040998	496
043362	043755	044148	044539	044932	393
047275	047664	048053	048442	048830	389
051153	051538	051924	052309	052694	386
054996	055378	055760	056142	056524	382
058805	059185	059563	059942	060320	379
062582	062958	063333	063709	064083	376
066326	066699	067071	067443	067815	372
070039	070407	070776	071145	071514	369
073718	074085	074451	074816	075182	366
077368	077731	078094	078457	078819	363
080987	081347	081707	082067	082426	360
084576	084934	085291	085647	086004	357
088136	088490	088845	089198	089552	355
091667	092018	092369	092721	093071	351
095169	095518	095866	096215	096562	349
098644	098989	099335	099681	100026	346
102091	102434	102777	103119	103462	342
105510	105851	106191	106531	106871	340
108903	109241	109579	109916	110253	338
112269	112605	112939	113275	113609	335

The Table of Logarithmes.

N	0	1	2	3	4
130	113943	114277	114611	114944	115278
131	117271	117603	117934	118265	118595
132	120574	120903	121231	121559	121888
133	123852	124178	124504	124830	125156
134	127105	127429	127753	128076	128399
135	130334	130655	130977	131298	131619
136	133539	133858	134177	134496	134814
137	136721	137037	137354	137671	137987
138	139879	140194	140508	140822	141136
139	143015	143327	143139	143951	144263
140	146128	146438	146748	147058	147367
141	149219	149527	149835	150142	150449
142	152288	152594	152899	153225	153509
143	155336	155639	155943	156246	156549
144	158362	158664	158965	159266	159567
145	161368	161667	161967	162266	162564
146	164352	164650	164947	165244	165541
147	167317	167613	167908	168202	168497
148	170262	170555	170848	171141	171434
149	173186	173478	173769	174059	174351
150	176091	176381	176669	176959	177248
151	178977	179264	179552	179829	180126
152	181844	182129	182415	182699	182985
153	184691	184975	185259	85542	185825
154	187521	187803	188084	188316	188647
155	190332	190612	190892	191171	19145
156	193125	193403	193681	193959	194237
157	195899	196176	196453	196729	197005
158	198657	198932	199206	99481	199755
158	201397	201670	201942	202216	202488

5	6	7	8	9	D
115611	115943	116276	116608	116939	333
118926	119256	119586	119915	120245	330
122216	122544	122871	123198	123525	328
125481	125806	126131	126456	126781	325
128722	129045	129268	129689	130012	323
131939	132259	132579	132899	133219	321
135133	135451	135769	136086	136403	318
138303	138618	138934	139249	139564	315
141449	141763	142076	142389	142702	314
144574	144885	145196	145507	145818	311
147676	147985	148294	148603	148911	309
150756	157154	151369	151676	151982	307
153815	154119	154423	154728	155032	305
156852	157154	157457	157759	158061	303
159868	160168	160469	160769	161068	301
162862	163161	163459	163758	164055	299
165838	166134	166430	166726	167022	297
168792	169086	169380	169674	169968	295
171726	172019	172311	172603	172895	293
174641	174932	175222	175512	175802	291
177536	177825	178113	178401	178689	289
180413	180699	180986	181272	181558	287
183269	183555	183839	184123	184407	285
186108	186674	186674	186956	187239	283
188928	189209	189490	189771	190051	281
191730	192009	192289	192567	192846	279
194514	194792	195069	195346	195623	278
197281	197556	197832	198107	198382	276
200029	200303	200577	200850	201124	274
202761	203033	203303	203577	203848	272

N	0	1	2	3	4
160	204119	204391	204663	204934	205204
161	206826	207096	207365	207364	207904
162	209515	209783	210051	210319	210586
163	212187	212454	212720	212986	213252
164	214844	215109	215373	215638	215902
165	217484	217747	218010	218273	218536
166	220108	220369	220631	220892	221153
167	222716	222976	223236	223496	223755
168	225309	225568	225826	226084	226342
169	227887	228142	228400	228657	228913
170	230449	230704	230959	231215	231469
171	232996	233250	233504	233757	234011
172	235528	235781	236033	236285	239537
173	238046	238297	238548	238799	239049
174	240549	240799	241048	241297	241546
175	243038	243286	243534	243782	244029
176	245513	245759	246006	246252	246499
177	247973	248219	248464	248709	248954
178	250420	250664	250908	251151	251395
179	252853	253096	253334	253580	253822
180	255273	255514	255755	255996	256237
181	257679	257918	258158	258398	258637
182	260071	260309	260548	260787	261025
183	262451	262688	262925	263162	263399
184	264818	265054	265289	265525	265761
185	267172	267406	267641	267875	268109
186	269513	269746	269979	270213	270446
187	271842	272074	272306	272538	272769
188	274158	274389	274619	274850	275081
189	276462	276692	276921	277151	277379

5
205475
208173
210853
213518
216166
218798
221414
224015
226599
229169
231724
234264
236789
239299
241795
244277
246745
248198
251638
254064
256477
258877
261263
263636
265996
268344
270679
273001
275311
277609

5	6	7	8	9	D
205475	205746	206016	206286	206556	271
208173	208441	208710	208978	209247	269
210853	211121	211388	211654	211921	267
213518	213783	214049	214314	214579	266
216166	216429	216694	216957	217221	264
218798	219060	219323	219585	219846	262
221414	221675	221936	222196	222456	261
224015	224274	224533	224791	225051	259
226599	226858	227115	227372	227629	258
229169	229426	229682	229939	230193	256
231724	231979	232234	232488	232746	254
234264	234517	234770	235023	235276	253
236789	237041	237292	237544	237795	252
239299	239549	239799	240049	240299	250
241795	242044	242293	242441	242789	249
244277	244525	244772	245019	245266	248
246745	246991	247237	247482	247728	246
248198	249443	249687	249932	250176	245
251638	251881	252125	252368	252610	243
254064	254306	254548	254789	255031	242
256477	256718	256958	257198	257438	241
258877	259116	259355	259594	259833	239
261263	261501	261739	261976	262214	238
263636	263873	264109	264346	264582	237
265996	266232	266467	266702	266937	235
268344	268578	268812	269046	269279	234
270679	270912	271144	271377	271609	233
273001	273233	273464	273696	273927	232
275311	275542	275772	276002	276232	230
277609	277838	278067	278296	278525	229

N	0	1	2	3	4
190	278754	278982	279211	279439	279667
191	281033	281261	281488	281714	281942
192	283301	283527	283753	283976	284205
193	285557	285782	286007	286232	286456
194	287802	288026	288249	288473	288696
195	290035	290257	290479	290702	290925
196	292256	292478	292699	292920	293141
197	294466	294687	294907	295127	295347
198	296665	296884	297104	297323	297542
199	298853	299071	299289	299507	299725
200	301029	301247	301464	301581	301898
201	303196	303412	303628	303844	304059
202	305351	305566	305781	305996	306211
203	307496	307709	307924	308137	308351
204	309630	309843	310056	310268	310421
205	311754	311966	312177	312389	312600
206	313867	314078	314289	314499	314709
207	315970	316180	316389	316599	316809
208	318063	318270	318481	318689	318898
209	320146	320354	320562	320769	320977
210	322219	322426	322633	322839	323046
211	324282	324488	324694	324899	325105
212	326336	326541	326745	326949	327155
213	328379	328583	328787	328991	329194
213	330414	330617	330819	331022	331225
215	332438	332640	332842	333044	333246
216	334454	334655	334856	335057	335257
217	336459	336659	336856	337059	337259
218	338456	338656	338856	339054	339253
219	340444	340642	340841	341039	341237

5	6	7	8	9	D
279895	280123	280351	280578	280896	228
282169	282396	282622	282849	283075	227
284431	284656	284882	285107	285332	226
286681	286905	287129	287354	287578	225
288919	289143	289366	289589	289812	223
291147	291369	291591	291813	292034	222
293362	293584	293804	294025	294246	221
295567	295787	296007	296226	296446	220
297761	297979	298198	298416	298635	219
299943	300161	330378	000595	300813	218
302114	302331	302547	302764	302979	217
304275	304491	304706	304921	305136	216
306425	306639	306854	307068	307282	215
308564	308778	308991	309204	309417	313
310693	310906	311118	311329	311542	212
312812	313023	313234	313445	313656	211
314910	315130	315340	315551	315760	210
317018	317227	317436	317646	317854	209
319106	319314	319522	319730	319938	208
321184	321391	321598	321805	322012	207
323252	323458	323665	323871	324077	206
325310	325516	325721	325926	326131	205
327359	327563	327767	327972	328176	204
329398	329601	329805	330008	330211	203
331427	331629	331832	332034	332256	202
333447	333649	333850	334051	334253	202
335458	335658	335859	336055	336255	201
337459	337659	337858	338058	338257	200
339451	339650	339849	340047	340246	199
341435	341632	341830	342028	342225	198

N	0	1	2	3	4
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221	344392	344589	344785	344981	345178
222	346353	346549	346744	346939	347135
223	348305	348499	348694	348889	349083
224	350258	350442	350636	350829	351023
225	352183	352375	352568	352761	352954
226	354108	354301	354493	354685	354876
227	356026	356217	356408	356599	356790
228	357935	358125	358316	358506	358696
229	359835	360025	360215	360404	360593
230	361728	361917	362105	362294	362482
231	363612	363799	363988	364176	364363
232	365488	365645	365862	366049	366236
233	367356	367542	367729	367915	368101
234	369216	369401	369587	369772	369958
235	371068	371253	271437	371622	371806
236	372912	373094	373279	373464	373647
237	376577	374932	375115	375298	375481
238	376577	376759	376942	377124	377336
239	378398	378579	378761	378943	379124
240	380211	380392	380573	380754	380934
241	282017	382197	382377	382557	382737
242	383815	383995	384174	384353	384533
243	385606	385785	385964	386142	386321
244	387389	387568	387746	387923	388101
245	389166	389343	389520	389698	389875
246	390935	391112	391288	391464	391641
247	392697	392873	393048	393224	393399
248	394452	394627	394802	394977	395152
249	396199	396374	396548	396722	396896

5	6	7	8	9	D
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345373	345569	345766	345962	346157	196
347330	347525	347720	347915	348110	195
349278	349472	349659	349860	350054	194
351216	351409	351603	351796	351989	193
353147	353339	353532	353724	353916	193
355068	355239	355452	355643	355834	192
356981	357172	357363	357554	357744	191
358886	359076	359266	359456	359646	190
360783	360972	361161	361350	361539	189
362671	362859	363048	363236	363424	188
364551	364739	364926	365112	365301	188
366423	366609	366796	366982	367169	187
368287	368473	368659	368845	369030	186
370143	370328	370513	370698	370882	185
371991	372175	372359	372544	372728	184
373831	374015	374198	374382	374565	184
375664	375846	376029	376212	376394	183
377488	377670	377852	378034	378216	182
379306	379487	379668	379849	380030	181
381115	381296	381476	381656	381837	181
382917	383097	383277	383456	383636	180
384712	384891	385069	385249	385428	179
386499	386677	386856	387034	387212	178
388279	388456	388634	388811	388989	178
390051	390228	390405	390582	390759	177
391817	391993	392169	392345	392521	179
393575	393751	393926	394101	394177	176
395326	395501	395676	395850	96025	175
397071	397245	397419	397592	397766	174

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251	399674	399847	400019	400192	400365
252	401401	401573	401745	401917	402089
253	403121	403292	403464	403635	403807
254	404834	405005	405176	405346	405517
255	406540	406710	406881	407051	407221
256	408239	408409	408579	408749	408918
257	409933	410102	410271	410439	410609
258	411619	411788	411956	412124	412293
259	413299	413467	413635	413803	413969
260	414973	415140	415307	415474	415641
261	416641	416807	416973	417139	417306
262	418301	418467	418933	418798	418964
263	419956	420121	420286	420451	420616
264	421604	421768	421933	422097	422261
265	423246	423409	423574	423737	423901
266	424882	425045	425208	425371	425534
267	426411	426674	426836	426999	427161
268	428135	428297	428499	428621	428783
269	429752	429914	430075	430236	430398
270	431364	431525	431685	431846	432007
271	432969	433129	433289	433449	433609
272	434569	434729	434888	435048	435207
273	436162	436322	436481	436639	436799
274	437751	437909	438067	438226	438384
275	439333	439491	439648	439806	439964
276	440909	441066	441224	441381	441538
277	442479	442637	442793	442949	443106
278	444045	444201	444357	444513	444669
279	445604	445759	445915	446071	446226

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398808	398981	399154	399328	399501	173
400538	400711	400883	401056	401228	173
402261	402433	402605	402777	402949	172
403978	404149	404320	404492	404663	171
405688	405858	406029	406199	406869	171
407391	407561	407731	407901	408070	170
409087	409257	409426	409595	409764	169
410777	410946	411114	411283	411451	169
412461	412629	412796	412964	413132	168
414137	414405	414472	414639	414806	167
415808	415974	416141	416308	416474	167
417472	417638	417804	417969	418135	166
419129	419295	419460	419625	419791	165
420781	420945	421110	421275	421439	165
422426	422589	422754	422918	423082	164
424065	424228	424392	424555	424718	164
425697	425860	426023	426186	426349	163
427324	427486	427648	427811	427973	162
428944	429106	429268	429429	429591	162
430559	430719	430881	431042	431203	161
432167	432328	432488	432649	432809	161
433769	433929	434089	434249	434409	160
435366	435526	435685	435844	436004	159
436957	437116	437275	437433	437592	159
438542	438701	438859	439017	439175	148
440122	440279	440437	440594	440752	158
441695	441852	442009	442166	442323	157
443263	443419	443576	443732	443889	157
444825	444981	445137	445293	445449	156
446382	446537	446692	446848	447003	155

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283	451786	451939	452093	452247	452399
284	453318	453471	453624	453777	454929
285	454845	454997	455149	455302	455454
286	456366	456518	456669	456821	456973
287	457889	458033	458184	458336	458487
288	459392	459543	459694	459845	459995
289	460898	461048	461196	461348	461499
290	462398	462548	462697	462847	462997
291	463893	464042	464191	464340	464489
292	465383	465532	465680	465829	465977
293	466868	467016	467164	467312	467460
294	468347	468495	468643	468790	468938
295	469822	469969	470116	470263	470410
296	471292	471438	471585	471732	471878
297	472756	472903	473049	473195	473341
298	474216	474362	474508	474653	474799
299	475671	475816	475962	476107	476252
300	477121	477266	477411	477555	477699
301	478566	478711	478855	478999	479123
302	480007	480151	480294	480438	480582
303	481443	481586	481729	481872	482016
304	482874	483016	483159	483302	483445
305	484299	484442	484585	484727	484869
306	485721	485863	486005	486147	486289
307	487138	487279	487421	487564	487704
308	488551	488692	488832	488974	489114
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449478	449633	449787	449941	450095	154
451018	451172	451326	451479	451633	154
452553	452706	452859	453012	453165	153
455082	454235	454387	454539	454692	463
455606	455758	455910	456062	456214	152
457125	457276	457428	457579	457731	152
458638	458789	458939	459091	459242	151
460146	460296	460447	460597	460748	151
461649	461799	461948	462098	462248	150
463146	463296	463445	463594	463744	150
464639	464788	464936	465085	465234	149
466126	466274	466423	466571	466719	149
467608	467756	467904	468052	468199	148
469085	469233	469380	469527	469675	447
470557	470704	470851	470998	471145	147
472025	472171	472318	472464	472610	146
473487	473633	473779	473925	474071	146
474944	475089	475235	475381	475526	146
476367	476542	476687	476833	476976	145
477844	477989	478133	478278	478422	145
479287	479431	479575	479719	479863	144
480725	480869	481012	481156	481299	144
482159	482302	482445	482588	482731	143
483587	482729	483872	484015	484157	143
485011	485153	485295	485437	485579	142
486430	486572	486714	486855	486997	142
487845	487986	488127	488269	488409	141
489255	489396	489537	489677	489818	141
490661	490801	490941	491081	491122	140

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313	495544	495683	495822	495960	496099
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315	498311	498448	498586	498724	498862
316	499687	499824	499962	500099	500236
317	501059	401196	501333	501470	501607
818	502427	502564	502700	502837	502973
319	503791	503927	504063	504199	504335
320	505149	505286	505421	505557	505693
321	506505	506640	506776	506911	507046
322	507856	507991	508126	508260	508395
323	509203	509337	509471	509606	509740
324	510545	510679	510813	510947	511081
325	511883	512017	512151	512284	512418
326	513218	513351	513484	513617	513750
327	514584	514681	514813	514946	515079
328	515874	516006	516139	516271	516403
329	517196	517328	517459	517592	517724
330	518514	518646	518777	518909	519040
331	519828	519959	520090	520221	520353
332	521138	521269	521399	521530	521661
333	522444	522575	522705	522835	522966
334	523746	523876	523876	524136	524266
335	525045	525174	525304	525434	525563
336	526339	526469	526598	526727	526856
337	527629	527759	527888	528016	528145
338	528916	529045	529174	529302	529430
339	530199	530328	530456	530584	530711

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493458	493597	49373	493876	494015	139
494850	494989	495128	495267	495406	139
496238	496376	496515	496652	496791	139
497621	497759	497897	498035	498173	138
498999	499137	499275	499412	499549	138
500374	500510	500648	500785	500922	137
501744	501880	502017	502154	502291	137
503109	503246	503382	503518	503655	136
504471	504607	504743	504878	505014	136
505828	505964	506099	506234	506369	136
507181	507316	507451	507586	507721	135
508529	508664	508799	508934	509068	135
509874	510009	510143	510277	510411	134
511215	511349	511482	511616	511749	134
512551	512684	512818	512951	513084	133
513883	514016	514149	514282	514415	133
515211	515344	515476	515609	515741	133
516535	516668	516799	516931	517064	132
517855	517987	518119	518251	518382	132
519171	519303	519434	519566	519697	131
520484	520615	520745	520876	521007	131
521792	521922	522053	522183	522314	131
523096	523226	523356	523586	523616	130
524396	524526	524656	424785	524915	130
525693	525822	525951	526081	526210	129
526985	527114	527243	527372	527501	129
528274	528402	528531	528659	528788	129
529559	529687	529815	529943	530072	128
530839	530968	531096	531222	531351	128

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342	534026	534153	534280	534407	534534
343	535294	535421	535547	535674	535800
344	536558	536685	536811	536937	537063
345	537819	537945	538071	538197	538322
346	539076	539202	539327	539452	539578
347	540329	540455	540579	540705	540829
348	541579	541704	541829	541953	542078
349	542825	542929	543072	543199	543323
350	544008	544192	544316	544440	544562
351	545307	545431	545555	545678	545802
352	546543	546666	546789	546913	547036
353	547775	547898	548021	548144	548267
354	549003	549126	549229	549371	549492
355	550228	550351	550473	550595	550717
356	551449	551572	551694	551816	551938
357	552668	552789	552911	553033	553155
358	553883	554004	554126	554247	554368
359	555094	555215	555336	555457	555578
360	556303	556423	556544	556664	556785
361	557507	557627	557748	557868	557988
362	558709	558829	558948	559068	559188
363	559907	560026	560146	560265	560385
364	561101	561221	561339	561459	561578
365	562293	562412	562531	562649	562769
366	563481	563599	563718	563837	563955
367	564666	564784	564903	565921	565139
368	565848	565966	566084	566202	566319
369	567026	567144	567262	567379	567497

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533391	533518	533645	533772	533899	127
534661	534787	534914	535041	535167	127
535927	536053	536179	536304	536432	126
537189	537315	537441	537567	537693	126
538448	538574	538699	538825	538951	126
539703	539829	539954	540079	540204	125
540955	541079	541205	541329	541454	125
542203	542327	542452	542576	542701	125
543447	543571	543696	543819	543944	124
544688	544812	544934	545059	545183	124
545925	546049	546172	546296	546419	124
547159	547282	547405	547529	547652	123
548389	548512	548635	548758	548881	123
549616	549739	549861	549984	550106	122
550839	550962	551084	551206	551328	122
552059	552181	552303	552425	552547	122
553276	553386	553519	553640	553762	121
554489	554610	554731	554852	554973	121
555699	555819	555940	556061	556182	121
556905	557026	557146	557267	557387	120
558108	558228	568349	558469	558589	120
559308	559428	559548	559667	559787	120
560504	560624	560743	560863	560982	119
561698	561817	561936	562055	562174	119
562887	563006	563125	563244	563362	119
564074	564192	564311	564429	564548	119
565257	565376	565494	565612	565729	118
566437	566555	566673	566791	566909	118
567614	567732	567849	567967	568084	118

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371	569374	569491	569608	56972	569842
372	570543	570659	570776	57089	571009
373	571709	571825	571942	572058	572174
374	572872	572988	573104	573219	573336
375	574041	574147	574263	574379	574494
376	575188	575303	575419	575534	575649
377	576341	576457	576572	576687	576802
378	577492	577607	577722	577836	577951
379	578639	578754	578868	578983	579097
380	579784	579898	580012	580126	580241
381	580925	581039	581153	581267	581381
382	582063	582177	582291	582404	582518
383	583199	583312	583426	583539	583652
384	584331	584444	584587	584670	584783
385	585461	585574	585686	585799	585912
386	586587	586699	586812	586925	587037
387	587711	587823	587935	588047	588159
388	588832	588944	589056	589167	589279
389	589949	590061	590173	590284	590396
390	591065	591176	591287	591399	591509
391	592177	592288	592399	592509	592621
392	593286	593397	593508	593618	593729
393	594393	94503	594614	594724	594834
394	595496	595606	595717	595827	595937
395	596597	596707	596817	596927	597037
396	597695	597805	597914	598024	598134
397	598790	598899	599009	599119	599228
399	599883	599992	600101	600210	600319
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5	6	7	8	9	D
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569959	570076	570193	570309	570426	117
571126	571243	571359	571476	571592	117
572291	572407	572523	572639	572755	116
572452	573568	573684	573799	573915	116
574609	474726	574841	574957	575072	116
575765	575880	575996	576111	576226	115
576917	577032	577147	577262	577377	115
578066	578181	578295	578409	578525	115
579212	579326	579441	579555	579669	114
580355	580469	580583	580697	580811	114
581495	581608	581722	581836	581949	114
582631	582745	582858	582972	583085	114
583765	583879	583992	584105	584218	113
584896	585009	585122	585235	585348	113
586024	586137	586249	586362	586475	113
587149	587262	587374	587486	587599	112
588272	588384	588496	588608	588719	112
589391	589503	589615	589726	589838	112
590507	590619	590750	590842	590953	112
591621	591732	591843	591955	592066	111
592732	592843	592954	593064	593175	111
593839	593950	594061	594171	594282	111
594945	595055	595165	595276	595386	110
596047	596167	596157	596377	596487	110
597146	597256	597366	597476	597586	110
598243	598353	598462	598572	598681	110
599337	599446	599556	599665	599774	109
600428	600537	600646	600755	600864	109
601517	601625	601734	601843	601951	109

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403	605305	605413	605521	605628	605736
404	606381	606489	606596	606704	606811
405	607455	607562	607669	607777	607884
406	608526	608633	608739	608847	608954
407	609594	609701	609808	609914	610021
408	610660	610767	610873	610979	611086
409	611723	611829	611936	612042	612148
410	612784	612889	612996	613102	613207
411	613842	613947	614053	614159	614264
412	614897	615003	615108	615213	615319
413	615950	616055	616160	616265	616370
414	617000	617105	617210	617315	617419
415	618048	618153	618257	618362	618466
416	619093	619198	619302	619406	619511
417	620136	620240	620344	620448	620552
418	621176	621280	621384	621448	621592
419	622214	622318	622421	622525	622628
420	623249	623353	623456	623559	623663
421	624282	624385	624488	624591	624695
422	625312	625415	625518	625621	625724
423	626340	626443	626546	626648	626751
424	627366	627468	627571	627673	627775
425	628389	628491	628593	628695	628797
426	629409	629512	629613	629715	629817
427	630428	630529	630631	630733	630835
428	631444	631647	631647	631748	631849
429	632457	632559	632559	632761	632862

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603686	603794	603902	604009	604118	108
604766	604874	604982	505089	605197	108
605844	605951	606059	606166	606274	108
606919	607026	607133	607241	607348	107
607991	608098	608205	601312	608419	107
609061	609167	609274	609381	609488	107
610128	610234	610341	610447	610554	107
611192	611298	611405	611511	611617	106
612254	612359	612466	612572	612678	106
613313	613419	613525	613630	613736	106
614369	614475	614581	614686	614792	106
615424	615529	615634	615739	615845	105
616476	616581	616686	616790	616895	105
617525	617629	617734	617839	617943	105
618571	618676	618780	618884	618989	105
619615	619719	619824	619928	620032	104
620656	620760	620864	620968	621072	104
621695	621799	621902	622007	622110	104
622732	622835	622939	623042	623146	104
623766	623869	623973	624076	624179	103
624798	624901	625004	625107	625209	103
625827	625929	626032	626135	626237	103
626853	626956	627058	627161	627263	103
627878	627979	628082	628185	628287	102
628899	629002	629104	629206	629308	103
629919	630021	630123	630224	620326	102
630936	631038	631139	631241	631342	102
631951	632052	632153	632255	632356	101
632963	633064	633165	633266	623267	101

The Table of Logarithmes.

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433	636488	636588	636688	636789	636889
434	637489	637589	637689	637789	637889
435	638489	638583	638689	638789	638888
436	639486	639586	639686	639785	639885
437	640481	640581	640680	640779	640879
438	641475	641573	641672	641771	641871
439	642465	642563	642662	642761	642860
440	643453	643551	643650	643749	643847
441	644439	644537	644636	644734	644832
442	645422	645521	645619	645717	645815
443	646404	646502	646599	646698	646796
444	647383	647481	647579	647676	647774
445	648360	648458	648555	648653	648750
446	649335	649432	649529	649627	649724
447	650308	650405	650502	650599	650696
448	651278	651375	651472	651569	651666
449	652246	652343	652439	652536	652633
450	65321[illegible]	653309	653405	653502	653598
451	654177	654273	654369	654465	654562
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991004	991049	991093	991137	991182	44
991448	991492	991536	991580	991625	44
991890	991935	991979	992023	992067	44
992333	992377	992421	992465	992509	44
992774	992819	992863	992907	992951	44
993216	993259	993304	993348	993392	44
993657	993701	993745	993789	993833	44
994097	994141	994185	994229	994273	44
994537	994581	994625	994669	994713	44
994977	995021	995065	995108	995152	44
995416	995459	995504	995547	995591	44
995854	995898	995942	995986	996029	44
996293	996337	996380	996424	996468	44
996731	996774	996818	996862	996906	44
997168	997212	997255	997299	997343	44
997605	997648	997692	997736	997779	44
998041	998085	998129	998172	998216	44
998477	998521	998564	998608	998652	44
998912	998959	998999	999043	999087	44
999348	999392	999435	999479	999522	44
999783	999826	999869	999913	999957	43

A
TABLE
OF
Artificial Sines
AND
TANGENTS
To Every
DEGREE and MINUTE
OF THE
QUADRANT.

The Common Radius being 10,000,000.

LONDON,

Printed in the Year MDCCXIV.

Degree 0.

M	Sine	Co-ſine		Tangent	Co-tang.	
0	0.000000	10.000000		0.000000	*Infinita.*	60
1	6.463726	9.999999		6.463726	13.536274	59
2	6.764756	9.999999		.764756	13.235244	58
3	6.940847	9.999999		.940847	13.059153	57
4	7.065786	9.999999		.065786	12.934214	56
5	7.162696	9.999999		7.162696	12.837304	55
6	7.241877	9.999999		7.241878	12.758122	54
7	7.308824	9.999999		7.308825	12.691175	53
8	7.366816	9.999999		7.366817	12.633183	52
9	7.417968	9.999999		7.417970	12.582030	51
10	7.463726	9.999998		7.563727	12.536273	50
11	7.505118	9.999998		7.505120	12.494880	49
12	7.442906	9.699999		7.542909	12.457091	48
13	7.577668	9.999997		7.577272	12.422328	47
14	7.609853	9.999996		7.609857	12.390143	46
15	7.639816	9.999996		7.639826	12.360180	45
16	7.667844	9.999995		7.667849	12.332151	44
17	7.694173	9.999995		7.694179	12.305821	43
18	7.718977	9.999994		7.719003	12.281997	42
19	7.742477	9.999993		7.742484	12.257516	41
20	7.764754	9.999993		7.764761	12.235239	40
21	7.785943	9.999992		7.785951	12.214049	39
22	7.806146	9.999991		7.806145	12.193845	38
23	7.825451	9.999990		7.825460	12.174540	37
24	7.843934	9.999989		7.843944	12.156056	36
25	7.861662	9.999989		7.861674	12.138326	35
26	7.878695	9.999988		7.878708	12.121292	34
27	7.895085	9.999987		7.895099	12.104901	33
28	7.910879	9.999986		7.910894	12.089106	32
29	7.926119	9.999985		7.926134	12.073866	31
30	7.940842	9.999983		7.940858	12.059142	30
	Co-ſine	Sine		Co-tang.	Tangent	M

Degree 89.

Degree 0.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
30	7.940842	7.999983	7.940858	1.2059143	30
31	7.955082	9.999982	7.955100	12.044900	29
32	7.958870	9.999981	7.968889	12.031111	28
33	7.982233	9.999980	7.982253	12.017747	27
34	7.995198	9.999978	7.995215	12.004781	26
35	8.007787	9.999978	7.007810	11.992191	25
36	8.020021	9.999976	8.020044	11.979956	24
37	8.031919	9.999975	8.031945	11.968055	23
38	8.043501	9.999973	8.043527	11.956473	22
39	8.054781	9.999972	8.054809	11.945181	21
40	8.065776	9.999971	8.065806	11.934191	20
41	8.706500	9.999969	8.076531	11.923469	19
42	8.086965	9.999968	8.086997	11.913003	18
43	8.097183	9.999966	8.097217	11.902783	17
44	8.107167	9.999964	8.107203	11.892797	16
45	8.116926	9.999963	8.116963	11.883037	15
46	8.126471	9.999961	8.126510	11.873490	14
47	8.135810	9.99995	8.135851	11.864149	13
48	8.144953	9.999958	8.144996	11.855004	12
49	8.153907	9.999956	8.153952	11.846048	11
50	8.162681	9.999954	8.162737	11.837273	10
51	8.171280	9.999952	8.171328	11.828672	9
52	8.179713	9.999950	8.179763	11.820237	8
53	8.187985	9.999948	8.188036	11.811964	7
54	8.196102	9.999946	8.196156	11.803844	6
55	8.204070	9.999944	8.204126	11.795874	5
56	8.211895	9.999942	8.211953	11.788047	4
57	8.219581	9.999940	8.219641	11.780359	3
58	8.227134	9.999938	8.227195	11.772805	2
59	8.234557	9.999936	8.234621	11.765379	1
60	8.241855	9.999934	8.241921	11.758079	0
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 89.

Degree 1.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	8.241855	9.999934	8.241921	11.758079	69
1	8.249033	9.999932	8.249102	11.750898	59
2	8.256094	9.999929	8.256165	11.743835	58
3	8.263042	9.999927	8.263115	11.736885	57
4	8.269881	9.999925	8.269956	11.730044	56
5	8.276614	9.999922	8.276691	11.723309	55
6	8.283243	9.999920	8.283323	11.716677	54
7	8.289773	9.999918	8.289856	11.716144	53
8	8.296207	9.999915	8.296292	11.703708	52
9	8.302546	9.999913	8.302634	11.697368	51
10	8.308794	9.999910	8.308884	11.691116	50
11	8.314954	9.999907	8.315046	11.684954	49
12	8.321027	9.999905	8.321122	11.678878	48
13	8.327016	9.999902	8.327114	11.672886	47
14	8.332924	9.999899	8.333025	11.666975	46
15	8.338753	9.999897	8.338856	11.661144	54
16	8.344504	9.999894	8.344610	11.655390	44
17	8.350180	9.999891	8.350289	11.649711	43
18	8.355783	9.999888	8.355895	11.644105	41
19	8.361315	9.999885	8.361430	11.638570	40
20	8.366777	9.999882	8.366895	11.633105	4
21	8.372171	9.999879	8.372292	11.627708	39
22	8.377499	9.999876	8.377622	11.622378	38
23	8.382762	9.999873	8.382889	11.617111	37
24	8.387962	9.999870	8.388092	11.611908	36
25	8.393101	9.999867	8.393234	11.606766	35
26	8.398179	9.999864	8.398315	11.601685	34
27	8.403199	9.999861	8.403338	11.596662	33
28	8.408161	9.999858	8.408304	11.591696	32
29	8.413068	9.999854	8.413213	11.586787	31
30	8.417919	9.999851	8.418068	11.581932	30
	Co-sine	Sine	*Co-tang.*	Tangent	

Degree 88.

Degree 1.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	8.417919	9.999851	8.418068	11.581932	30
31	8.422717	9.999848	8.422869	11.577131	29
32	8.427462	9.999844	8.427618	11.572382	28
33	8.432156	9.999841	8.432315	11.567685	27
34	8.436800	9.999838	8.436962	11.563038	26
35	8.441394	9.999834	8.441560	11.558440	25
36	8.445941	9.999831	8.446110	11.553990	24
37	8.450440	9.999827	8.450613	11.549387	23
38	8.454893	9.999824	8.455070	11.544930	22
39	8.459301	9.999820	8.459481	11.540519	21
40	8.463665	9.999816	8.463849	11.536151	20
41	8.467985	9.999812	8.468172	11.531828	19
42	8.472263	9.999809	8.472454	11.527546	18
43	8.476498	9.999805	8.476693	11.523307	17
44	8.480693	9.999801	8.480892	11.519108	16
45	8.484848	9.999797	8.485050	11.514940	15
46	8.488963	9.999794	8.489170	11.510830	14
47	8.493040	9.999790	8.493250	11.506750	13
48	8.497078	9.999786	8.497295	11.502707	12
49	8.501080	9.999782	8.501298	11.498702	11
50	8.505045	9.999778	8.505267	11.494733	10
51	8.508974	9.999774	8.509200	11.490800	9
52	8.512867	9.999769	8.513098	11.486902	8
53	8.516726	9.999765	8.516961	11.483039	7
54	8.520551	9.999761	8 520790	11.479210	6
55	8.524343	9.999756	8.524586	11.475414	5
56	8.528102	9.999753	8.528349	11.471651	4
57	8.531828	9.999748	8.532080	11.467920	3
58	8.535523	9.999744	8.535779	11.464221	2
59	8.539186	9.999740	8.539447	11.460553	1
60	8.542819	9.999735	8.543084	11.456916	0
	Co-ſine	Sine	Co-tang.	Tangent	

Degree 88.

Degree 2.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	8.542819	9.999735	8.543084	11.456916	60
1	8.546422	9.999731	8.546691	11.453309	59
2	8.549995	9.999726	8.550268	11.449732	58
3	8.553558	9.999722	8.553817	11.446183	57
4	8.557054	9.999717	8.557336	11.442664	56
5	8.560540	9.999713	8.560827	11.439172	55
6	8.563995	9.999708	8.564291	11.435709	54
7	8.567431	9.999703	8.567727	11.432272	53
8	8.570836	9.999699	8.571137	11.428863	52
9	8.574214	9.999694	8.574520	11.425480	51
10	8.577566	9.999689	8.577877	11.422123	50
11	8.580892	9.999685	8.581208	11.418792	49
12	8.584193	9.999680	8.584514	11.415486	48
13	8.587469	9.999675	8.587795	11.412205	47
14	8.590721	9.999670	8.591051	11.408949	46
15	8.593948	9.999665	8.594283	11.405717	45
16	8.597152	9.999660	8.597492	11.402508	44
17	8.600332	9.999655	8.600677	11.399323	43
18	8.603488	9.999650	8.603838	11.396161	42
19	8.606622	9.999645	8.606978	11.393022	41
20	8.609734	9.999640	8.610094	11.389906	40
21	8.612823	9.999635	8.613189	11.386811	39
22	8.615891	9.999629	8.616262	11.383738	38
23	8.618937	9.999624	8.619313	11.380687	37
24	8.621967	9.999619	8.622343	11.377657	36
25	8.624965	9.999614	8.625352	11.374648	35
26	8.627948	9.999608	8.628340	11.371660	34
27	8.630911	9.999603	8.631308	11.368692	33
28	8.633854	9.999597	8.634456	11.365744	32
29	8.636776	9.999592	8.637184	11.362816	31
30	8.639679	9.999586	8.640093	11.359907	30
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 87.

Degree 2.

M	Sine	*Co sine*	Tangent	*Co-tang.*	
30	8.639679	9.999586	8.640093	11.359907	30
31	8.642563	9.999581	8.642982	11.357017	29
32	8.645428	9.999575	8.645653	11.354147	28
33	8.648274	9.999570	8.648704	11.351296	27
34	8.651102	9.999564	8.651538	11.348463	26
35	8.653911	9.999558	8.654352	11.345648	25
36	8.656702	9.999553	8.657149	11.342851	24
37	8.659475	9.999547	8.659928	11.340272	23
38	8.662230	9.999541	8.662689	11.337311	22
39	8.664968	9.999535	8.665433	11.334567	21
40	8.667689	9.999529	8.668160	11.331840	20
41	8.670393	9.999523	8.670869	11.329130	19
42	8.673080	9.999518	8.673563	11.326437	18
43	8.675751	9.999512	8.676239	11.323761	17
44	8.678405	9.999506	8.678899	11.321100	16
45	8.681043	9.999499	8.681544	11.318456	15
46	8.683665	9.999493	8.684172	11.315828	14
47	8.686272	9.999487	8.686784	11.313216	13
48	8.688892	9.999481	8.689381	11.310619	12
49	8.691438	9.999475	8.691963	11.308037	11
50	8.696998	9.999469	8.694529	11.305471	10
51	8.696543	9.999462	8.697081	11.302919	9
52	8.699073	9.999456	8.699617	11.300383	8
53	8.701589	9.999450	8.702139	11.297861	7
54	8.704090	9.999443	8.704646	11.295354	6
55	8.706576	9.999437	8.707139	11.292860	5
56	8.709049	9.999431	8.709618	11.290381	4
57	8.711507	9.999424	8.712083	11.287917	3
58	8.713952	9.999418	8.714534	11.285466	2
59	8.716383	9.999411	8.716972	11.283028	1
60	8.718800	9.999404	8.719396	11.280604	0
	Co-sine	Sine	*Co-tang.*	Tangent.	M

Degree 87.

Degree 3.

	Sine	*Co-ſine*	Tangeut	*Co-tang.*	M
0	8.718800	9.999404	8.719346	11.280604	60
1	8.721204	9.999398	8.721806	11.278194	59
2	8.723595	9.999391	8.724254	11.275796	58
3	8.725972	9.999384	8.726588	11.273412	57
4	8.728336	9.999378	8.728959	11.271041	56
5	8.730688	9.999371	8.731317	11.268683	55
6	8.733027	9.999364	8.733663	11.266337	54
7	8.735354	9.999357	8.735996	11.264004	53
8	8.737667	9.999350	8.738317	11.261683	52
9	8.739969	9.999343	8.740626	11.259374	51
10	8.742259	9.999336	8.742922	11.257078	50
11	8.744536	9.999329	8.745207	11.254793	49
12	8.746801	9.999322	8.747479	11.252521	48
13	8.745955	9.999315	8.749740	11.250240	47
14	8.751297	9.999308	8.751989	11.248011	46
15	8.753528	9.999301	8.754227	11.245773	45
16	8.755747	9.999294	8.756453	11.243547	44
17	8.757955	9.999286	8.758668	11.241332	43
18	8.760151	9.999279	8.760872	11.239128	42
19	8.762337	9.999272	8.763065	11.236935	41
20	8.764511	9.999265	8.765246	11.234754	40
21	8.766675	9.999257	8.767417	11.232583	39
22	8.768828	9.999250	8.769578	11.230422	38
23	8.770970	9.999242	8.771727	11.228273	37
24	8.773101	9.999235	8.773866	11.229134	36
25	8.775223	9.999227	8.775995	11.224005	35
26	8.777333	9.999220	8.778114	11.221886	34
27	8.779434	9.999212	8.783222	11.219778	33
28	8.781524	9.999204	8.782320	11.217680	32
29	8.783605	9.999197	8.784404	11.215592	31
30	8.785675	9.999119	8.786486	11.213514	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 86.

Degree 3.

M	Sine	Co-ſine	Tangest	Co-tang.	
30	8.785675	9 999189	8.786486	11.213514	30
31	8,787736	9.999181	8,781554	11,211446	29
32	8,789787	9,999174	8,790613	11,209387	28
33	8,791828	9,999166	8,792662	11,207338	27
34	8,793859	9,999158	8,794701	11,205299	26
35	8,795881	9,999150	8,796731	11,203269	25
36	8,797894	9,999142	8,798752	11,201248	24
37	8,799897	9,999134	8,800763	11,199237	23
38	8 801891	9,999126	8,802765	11,197235	22
39	8,803876	9,999118	8,807458	11.195242	21
40	8,805852	9 999110	8,806742	11,193258	20
41	8,807819	9,999102	8,808717	11,191283	19
42	8,809777	9,999094	8,812683	11,189317	18
43	8 811726	9,999086	8,812641	11,187359	17
44	8,813667	9,999077	8,814589	11,185411	16
45	8,815598	9,999069	8,816529	11,183471	15
46	8,817522	9,999061	8,818461	11,181539	14
47	8,819436	9,999052	8 820384	11,179616	13
48	8,821342	9,999044	8,822298	11,177702	12
49	8,823240	9,999036	8,824205	11,175795	11
50	8,825130	9,999027	8,826103	11,173897	10
51	8,827011	9,999019	8,827992	11,172008	9
52	8,828884	9,999019	8,829874	11,170126	8
53	8,830749	9,999002	8,831748	11,168252	7
54	8,832106	9,998993	8.833613	11,166377	6
55	8,834456	9,998484	8,835471	11,164529	5
56	8,836297	9,998976	8,837321	11,162679	4
57	8,838130	9,998967	8,839163	11,160837	3
58	8,839956	9 998958	8,840998	11,159002	2
59	8,841774	9,998940	8,842825	11,157175	1
60	8,843585	9,998941	8,844644	11,155356	0
	Co ſine	Sine	Co-tang.	Tangent.	M

Degree 86.

Degree 4.

M	Sine	Co·ſine	Tangent	Co-tang.	
0	8.843584	9.998941	8.844644	11.155356	60
1	8.845387	9.998931	8.846455	11.153445	59
2	8.847183	9.998923	8.848240	11.151740	58
3	8.848971	9.998914	8.850057	11.149943	57
4	8.85075	9.998905	8.851846	11.148154	56
5	8.852525	9.998896	8.853628	11.146372	55
6	8.854291	9.998887	8.855403	11.144597	54
7	.856049	9.998878	8.857171	11.142829	53
8	8.857801	9.998869	8.858932	11.141068	52
9	.859546	9.998860	8.860686	11.139314	51
10	.861283	9.998851	8.862433	11.137567	50
11	8.863014	9.998842	8.864173	11.135827	49
12	8.864738	9.998832	8 865906	11.134094	48
13	8.866454	9.998823	8.867632	11.132368	47
14	8.868165	9.998813	8.869351	11.130649	46
15	8.869868	9.998804	8.871064	11.128936	45
16	8.871565	9.998795	8.872750	11.127230	44
17	8.873255	9.998785	8.874469	11.125531	43
18	8.874938	9.998776	8.876162	11.123838	42
19	8.876615	9.998766	8.877849	11.122151	41
20	8.878285	9.998757	8.879529	11.120471	40
21	8.879949	9.998747	8.881202	11.118798	39
22	8.881607	9.998738	8.882896	11.117131	38
23	8.883258	9.998728	8.884530	11.115470	37
24	8.884903	9.998718	8.886185	11.113815	36
25	8.886542	9.998708	8.887833	11.112167	35
26	8.888174	9.998699	8.889476	11.110528	34
27	8.889801	9.998689	8.891112	11.108888	33
28	8.891421	9.698679	8.892742	11.107258	32
29	8.893035	9.998669	8.894366	11.105634	31
30	8.894643	9.998659	8.895984	11.104016	30
	Co-ſine	Sine	Co tang	Tangent	M

Degree 85.

Degree 4.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	M
30	8.894642	9.998659	8.845984	11.104016	30
31	8.896246	9.998649	8.897596	11.102404	29
32	8.897842	9.998639	8.899203	11.100797	28
33	8.899432	9.998629	8.900803	11.099197	27
34	8.901017	9.998619	8.902398	11.097602	26
35	8.902596	9.998609	8.903987	11.096013	25
36	8.904169	9.998599	8.905570	11.094430	24
37	8.905736	9.998589	8.907147	11.092853	23
38	8.907297	9.998577	8.908719	11.091281	22
39	8.908853	9.998568	8.910285	11.089715	21
40	8.910404	9.998558	8.911846	11.088154	20
41	8.911949	9.998548	8.913401	11.086599	19
42	8.913488	9.998537	8.914951	11.085049	18
43	8.915022	9.998527	8.916498	11.083505	17
44	8.916550	9.998516	8.918034	11.081966	16
45	8.918073	9.998506	8.919568	11.080432	15
46	8.919591	9.998495	8.921096	11.078904	14
47	8.921103	9.998485	8.922619	11.077381	13
48	8.922610	9.998474	8.924136	11.075864	12
49	8.924112	9.998464	8.925649	11.074351	11
50	8.925609	9.998453	8.927156	11.072844	10
51	8.927100	9.998442	8.928658	11.071344	9
52	8.928587	9.998431	8.930155	11.069845	8
53	8.930068	9.998421	8.931647	11.068353	7
54	8.931544	9.998410	8.933134	11.066866	6
55	8.933015	9.998399	8.934616	11.065384	5
56	8.934481	9.998388	8.936093	11.063907	4
57	8.935942	9.998377	8.937565	11.062435	3
58	8.937398	9.998366	8.939032	11.060968	2
59	8.938850	9.998355	8.940494	11.059506	1
60	8.940296	9.998344	8.941952	11.058048	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 85.

Degree 5.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	8.940296	9.998344	8.94 952	11.058048	60
1	8.941738	9.998333	8.943404	11.056596	59
2	8.943174	9.998322	8.944852	11.055148	58
3	8.944606	9.998311	8.946295	11.053705	57
4	8.946034	9.998300	8.947734	11.052266	56
5	8.957456	9.998289	8.949 68	11. 50832	55
6	8.958814	9.998277	8.950597	11.049403	54
7	8.950287	9.998266	8.952021	11.047979	53
8	8.951696	9.998255	8.953441	11.046559	52
9	8.953099	9.948243	8.954856	11.045144	51
10	8.954499	9.998232	3.956267	11.043733	50
11	8.955804	9.998220	8.957674	11.042326	49
12	8.957284	9.998209	8.959075	11.040925	48
13	8.958670	9.998197	8.960473	11.039527	47
14	8.960052	9.998186	8.961866	11.038134	46
15	8.961429	9.998174	8.963254	11.036746	45
16	8.962801	9.998163	8.964639	11.035361	44
17	8.964170	9.998151	8.966019	11.033981	43
18	8.965534	9.998139	8.967394	11.032606	42
19	8.966893	9.998128	8.968766	11.031234	41
20	8.968249	9.998106	8.970133	11.029867	40
21	8.969600	9.998104	8.971495	11.028505	39
22	8.970947	9.998092	8.972855	11.027145	38
23	8.972289	9.998080	8.974209	11.025791	37
24	8.973626	9.998068	8.975560	11.0 4440	36
25	8.974962	9.998056	8.976906	11.023094	35
26	.976293	9.998044	8.978248	11.021752	34
27	8.977619	9.998032	8.979586	11.020414	33
28	8.978941	9.998020	8.980921	11.019079	32
29	8.980259	9.998008	8.982251	11.017749	31
30	8.981573	9.997996	8.98357	11.016423	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 84.

Degree 5.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	8.981573	9.997996	8.983577	11.016423	30
31	8.982883	9.997984	8.984899	11.015101	29
32	8.984189	9.997971	8.986217	11.013783	28
33	8.985491	9.997959	8.987532	11.012468	27
34	8.986789	9.997947	8 988842	11.011158	26
35	8.988083	9.997935	8.990149	11.009851	25
36	8.989374	9 997922	8.991451	11.008549	24
37	8.990660	9.997910	8.992750	11.007250	23
38	6.991943	9.997897	8.994045	11.005955	22
39	8.993228	9.997885	8.995337	11.004663	21
40	8.994497	9.997873	8.996624	11.003376	20
41	8.995768	9.997860	8.997908	11.002092	19
42	8.997036	9.997847	8.999188	11.000812	18
43	8.998299	9.997835	9.000465	10.999534	17
44	8.999560	9.997822	9.001738	10.998262	16
45	9.000816	9.997809	9.003007	10.996993	15
46	9 002069	9.997797	9.004272	10.995728	14
47	9.003318	9.997794	9.005534	10.994466	13
48	9.004563	9.997771	9.006792	10.993208	12
49	9.005805	9.997758	9.008047	10.991953	11
50	9.007044	9.997722	9.009298	10.990702	10
51	9.008278	9.997732	9.010546	10.989454	9
52	9.009510	9.997719	9.011790	10.988210	8
53	9.010737	9.997706	9.013031	10.986969	7
54	9.011962	9.997693	9.014268	10.985732	6
55	9.013182	9.997680	9.015502	10.984498	5
56	9.014399	9.997667	9.016732	10.983268	4
57	9.015613	9.997654	9 017959	10 982041	3
58	9.016824	9.997641	9.019183	10.980817	2
59	9.018031	9.997628	9.020403	10.979597	1
60	9.019235	9.997614	9.021620	10.978380	0
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 84.

Degree 6.

M	Sine	*Co-ſine*	Tangeut	*Co-tang.*	
0	9.019235	9.997614	9.021620	10.978380	60
1	9.020435	9.997601	9.022834	10.977166	59
2	9.021632	9.997588	9.024044	10.975956	58
3	9.022825	9.997574	9.025251	10.974749	57
4	9.024016	9.997561	9.026455	10.973545	56
5	9.025203	9.997548	9.027655	10.972345	55
6	9.026386	9.997534	9.028852	10.971148	54
7	9.027567	9.997520	9.030046	10.969954	53
8	9.028744	9.997507	9.031237	10.968763	52
9	9.029918	9.997493	9.032425	10.967575	51
10	9.031089	9.997480	9.033609	10.966391	50
11	9.032257	9.997466	9.034791	10.965209	49
12	9.033421	9.997452	9.035969	10.964031	48
13	9.034582	9.997439	9.037144	10.962856	47
14	9.035741	9.997425	9.038316	10.961684	46
15	9.036896	9.997411	9.039485	10.960515	45
16	9.038048	9.997397	9.040651	10.959349	44
17	9.039197	9.997383	9.041813	10.958187	43
18	9.040342	9.997369	9.042973	10.957027	42
19	9.041485	9.997355	9.044130	10.955870	41
20	9.042625	9.997341	9.045284	10.954716	40
21	9.043762	9.997327	9.046434	10.953566	39
22	9.044895	9.997313	9.047582	10.952418	38
23	9.046026	9.997299	9.048727	10.951273	37
24	9.047154	9.997285	9.049869	10.950131	36
25	9.048279	9.997271	9.051008	10.948992	35
26	9.049400	9.997256	9.052144	10.947856	34
27	9.050519	9.997242	9.053277	10.946723	33
28	9.051635	9.997228	9.054408	10.945592	32
29	9.052749	9.992714	9.055535	10.944465	31
30	9.053859	9.997119	9.056640	10.943340	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 83.

Degree 6.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.053859	9.997199	9.056640	10.943340	30
31	9.054966	9.997185	9.057781	10.942219	29
32	9.056071	9.997170	9.058900	10.941100	28
33	9.057172	9.997156	9.060016	10.939984	27
34	9.058271	9.997141	9.061130	10.938870	26
35	9.059367	9.997127	9.062240	10.937760	25
36	9.060460	9.997112	9.063348	10.936652	24
37	9.061551	9.997098	9.064453	10.935547	23
38	9.062638	9.997083	9.065556	10.934445	22
39	9.063723	9.997068	9.066655	10.933345	21
40	9.064806	9.997053	9.067752	10.932248	20
41	9.065885	9.997039	9.068847	10.931153	19
42	9.066962	9.997024	9.069938	10.930062	18
43	9.068036	9.997009	9.071027	10.928973	17
44	9.069107	9.996994	9.072113	10.927887	16
45	9.070176	9.996979	9.073197	10.926803	15
46	9.071242	9.996964	9.074278	10.925722	14
47	9.072306	9.996949	9.075356	10.924644	13
48	9.073366	9.996934	9.076432	10.923568	12
49	9.074424	9.996919	9.077505	10.922495	11
50	9.075480	9.996604	9.078576	10.921424	10
51	9.076533	9.996886	9.079644	10.920356	9
52	9.077583	9.996874	9.080710	10.919290	8
53	9.078631	9.996858	9.081773	10.918227	7
54	9.079676	9.996843	9.082833	10.917167	6
55	9.080719	9.996823	9.083891	10.916109	5
56	9.081759	9.996812	9.084947	10.915053	4
57	9.082797	9.996797	9.085999	10.914000	3
58	9.083832	9.996782	9.087050	10.912950	2
59	9.084864	9.996766	9.088098	10.911902	1
60	9.085894	9.996751	9.089144	10.910856	0
	Co-ſine	Sine	*Co-tang.*	Tangent.	M

Degree 83.

Degree 7.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9.085894	9.996751	9.089144	10.910856	60
1	9.086922	9.996735	9.090187	10.909813	59
2	9.087947	9.996720	9.091228	10.908772	58
3	9.088970	9.996704	9.092266	10.907734	57
4	9.089990	9.996688	9.093302	10.906698	56
5	9.091088	9.996673	9.094336	10.905664	55
6	9.092024	9.996557	9.095367	10.904633	54
7	9.093037	9.996641	9.096395	10.903604	53
8	9.094047	9.996625	9.097422	10.902578	52
9	9.095056	9.996610	9.098446	10.901554	51
10	9.096062	9.996594	9.099468	10.900532	50
11	9.097065	9.996578	9.100487	10.899513	49
12	9.098066	9.996562	9.101504	10.898496	48
13	9.099065	9.996546	9.102519	10.897481	47
14	9.100062	9.996530	9.103532	10.896468	46
15	9.101056	9.996514	9.104542	10.895458	45
16	9.102048	9.996498	9.105550	10.894450	44
17	9.103037	9.996482	9.106556	10.893444	43
18	9.104025	9.996465	9.107559	10.892441	42
19	9.105010	9.996449	9.108560	10.891440	41
20	9.105992	9.996433	9.109559	10.890441	40
21	9.106973	9.996417	9.110556	10.889544	39
22	9.107951	9.996400	9.111551	10.888449	38
23	9.108927	9.996384	9.112542	10.887457	37
24	9.109901	9.996368	9.113533	10.886467	36
25	9.110873	9.996351	9.114521	10.885478	35
26	9.111842	9.996335	9.115507	10.884493	34
27	9.112809	9.996318	9.116491	10.883509	33
28	9.113774	9.996302	9.117472	10.882528	32
29	9.114737	9.996285	9.118452	10.881548	31
30	9.115698	9.996269	9.119429	10.880571	30
	Co-ſine	Sine	*Co-tang*	Tangent	M

Degree 82.

Degree 7.

M	Sine	Co-ſine.	Tangent	Co-tang.	
30	9.115698	9.996269	9.119425	10.880571	30
31	9 116656	9,996252	9,120404	10,879596	29
32	9,117612	9,996235	9,121377	10,878623	28
33	9,118567	9,996218	9,122348	10,877652	27
34	9,119519	9,996202	9,123317	10,876683	26
35	9,120469	9,996185	9,124284	10,875716	25
36	9,121417	9,996168	9,125248	10,874751	24
37	9,122362	9,996151	9,126211	10,873789	23
38	9,123306	9,996134	9,127172	10,872828	22
39	9,124248	9,996117	9,128130	10,871870	21
40	9,125187	9,996100	9,129087	10,870913	10
41	9,126125	9,996083	9,130041	10,869959	19
42	9,127060	9,996066	9,130994	10,869006	18
43	9,127993	9,996049	9,131944	10,868056	17
44	9,128925	9,996032	9,132893	10,867107	16
45	9,129854	9,996015	9,133839	10,866161	15
46	9,130781	9,995998	9,134784	10,865216	14
47	9,131706	9,995980	9,135726	10,864274	13
48	9,132630	9,995963	9,136666	10,863334	12
49	9,133551	9,995946	9,137605	10,862395	11
50	9,134470	9,995928	9,138542	10,861458	10
51	9,135387	9,995912	9,139476	10,860524	9
52	9,136303	9,995894	9,140409	10,859591	8
53	9,137216	9,995876	9,141340	10,858660	7
54	9,138127	9,995859	9,142469	10,857731	6
55	9,139037	9,995641	9,143196	10,856804	5
56	9,139944	9,995825	9,144121	10,855879	4
57	9,140850	9,995806	9,145044	10,854956	3
58	9,141754	9,995788	9,145965	10,854035	2
59	9.142655	9,995770	9,146885	10,853115	1
60	9,142555	9,995753	9,147803	10,852197	0
	Co-ſine	Sine	Co-tang.	Tangent	

Degree 82.

Degree 8.

M	Sine	*Co-ſine*	Tangent	*Co tang.*	
0	9.143555	9.995753	9.147803	10.852197	60
1	9.144453	9.995735	9.148718	10.851282	59
2	9.145349	9.995717	9.149632	10.850368	58
3	9.146243	9.995699	9.159544	10.849456	57
4	9.147136	9.995681	9.151454	10.848546	56
5	9.148026	9.995664	9.152363	10.847637	55
6	9.148915	9.995646	9.153269	10.846731	54
7	9.149801	9.995628	9.154174	10.845825	53
8	9.150686	9.995610	9.155077	10.844923	52
9	9.151569	9.995592	9.155978	10.844022	51
10	9.152451	9.995573	9.156877	10.843123	50
11	9.153330	9.995555	9.157775	10.842225	49
12	9.154208	9.995537	9.158671	10.841329	48
13	9.155082	9.995519	9.159565	10.840435	47
14	9.155957	9.995501	9.160457	10.839543	46
15	9.156830	9.995482	9.161347	10.838653	45
16	9.157700	9.995464	9.162236	10.837764	44
17	9.158569	9.995446	9.163123	10.836877	43
18	9.159436	9.995427	9.164008	10.835992	42
19	9.160301	9.995409	9.164892	10.835108	41
20	9.161164	9.995390	9.165773	10.834226	40
21	9.162025	9.995372	9.166654	10.833346	39
22	9.162885	9.995353	9.167532	10.832468	38
23	9.163743	9.995334	9.168409	10.831591	37
24	9.164600	9.995316	9.169284	10.830716	36
25	9.165454	9.995297	9.170157	10.829843	35
26	9.166307	9.995278	9.171029	10.828971	34
27	9.167158	9.995260	9.171899	10.828101	33
28	9.168008	9.995241	9.172767	10.827233	32
29	9.168856	9.995222	9.173634	10.826366	31
30	9.169702	9.995203	9.174499	10.825501	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 81.

Degree 8.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.169702	9.995203	9.174499	10.825501	30
31	9.170546	9.995184	9.175362	10.824638	29
32	9.171389	9.995165	9.176224	10.823776	28
33	9.172230	9.995146	9.177084	10.822916	27
34	9.173070	9.995127	9.177942	10.822058	26
35	9.173908	9.995108	9.178799	10.821202	25
36	9.174744	9.995089	9.179655	10.820345	24
37	9.175578	9.995070	9.180508	10.819492	23
38	9.176411	9.995061	9.181360	10.818640	22
39	9.177242	9.995032	9.182211	10.817789	21
40	9.178072	9.995012	9.183060	10.816640	20
41	9.178900	9.994993	9.183907	10.816093	19
42	9.179726	9.994974	9.184752	10.815248	18
43	9.180551	9.994955	9.185597	10.814403	17
44	9.181374	9.994935	9.186439	10.813561	16
45	9.182190	9.994916	9.187280	10.812720	15
46	9.183016	9.994896	9.188120	10.811880	14
47	9.183834	9.994876	9.188957	10.811042	13
48	9.184651	9.994857	9.189794	10.810206	12
49	9.185466	9.994838	9.190629	10.809371	11
50	9.186280	9.994818	9.191462	10.808538	10
51	9.187092	9.994798	9.192294	10.807706	9
52	9.187903	9.994779	9.193124	10.806876	8
53	9.188712	9.994759	9.193953	10.806047	7
54	9.189519	9.994739	9.194780	10.805220	6
55	9.190325	9.994719	9.195606	10.804394	5
56	9.191130	9.994699	9.196440	10.803569	4
57	9.191933	9.994680	9.197253	10.802747	3
58	9.192734	9.994660	9.198674	10.801926	2
59	9.193534	9.994640	9.198894	10.801106	1
60	9.194332	9.994620	9.199712	10.800287	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 81.

Degree 9.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9.194332	9.994620	9.199712	10.800287	60
1	9.195129	9.994600	9.200529	10.799470	59
2	9.195925	9.994580	9.201345	10.798655	58
3	9.196718	9.994560	9.202159	10.797841	57
4	9.197511	9.994540	9.202971	10.797029	56
5	9.198302	9.994519	9.203782	10.796218	55
6	9.199091	9.994499	9.204592	10.795408	54
7	9.199879	9.994479	9.205400	10.794600	53
8	9.200666	9.994459	9.206207	10.793793	52
9	9.201451	9.994438	9.207013	10.792987	51
10	9.202234	9.994418	9.207817	10.792183	50
11	9.203017	9.994398	9.208619	10.791381	49
12	9.203797	9.994377	9.209420	10.790580	48
13	9.204577	9.994357	9.210220	10.789780	47
14	9.205354	9.994336	9.211018	10.788982	46
15	9.206131	9.994316	9.211815	10.788185	45
16	9.206906	9.994295	9.212611	10.787389	44
17	9.207679	9.994274	9.213405	10.786595	43
18	9.208452	9.994254	9.214198	10.785802	42
19	9.209222	9.994233	9.214989	10.785011	41
20	9.209992	9.994212	9.215780	10.784220	40
21	9.210760	9.994191	9.216568	10.783432	39
22	9.211526	9.994171	9.217356	10.782644	38
23	9.212291	9.994150	9.218142	10.781758	37
24	9.213055	9.994129	9.218929	10.781074	36
25	9.213818	9.994108	9.219710	10.780290	35
26	9.214579	9.994087	9.220491	10.779508	34
27	9.215338	9.994066	9.221272	10.778728	33
28	9.216097	9.994044	9.222052	10.777948	32
29	9.216854	9.994024	9.222830	10.777170	31
30	9.217609	9.994003	9.223607	10.776393	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 80.

Degree 9.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.217609	9.994003	9.223607	10.776393	30
31	9.218363	9.993982	9.224382	10.775618	29
32	9.219116	9.993960	9.225156	10.774844	28
33	9.219868	9.993939	9.225929	10.774071	27
34	9.220618	9.993918	9.226704	10.773300	26
35	9.221367	9.993897	9.227471	10.772529	25
36	9.222115	9.993875	9.228240	10.771760	24
37	9.222861	9.993854	9.229007	10.770993	23
38	9.223606	9.993832	9.229774	10.770226	22
39	9.224349	9.993811	9.230539	10.769461	21
40	9.225092	9.993789	9.231302	10.768698	20
41	9.225833	9.993768	9.232065	10.767935	19
42	9.226573	9.993746	9.232826	10.767174	18
43	9.227311	9.993725	9.233586	10.766414	17
44	9.228048	9.993703	9.234345	10.765655	16
45	9.228784	9.993681	9.235103	10.764897	15
46	9.239518	9.993660	9.235859	10.764141	14
47	9.230252	9.993638	9.236614	10.763386	13
48	9.230984	9.993616	9.237368	10.762632	12
49	9.231715	9.993594	9.238120	10.761880	11
50	9.232444	9.993572	9.238872	10.761128	10
51	9.233172	9.993550	9.239622	10.760378	9
52	9.233899	9.993528	9.240371	10.759629	8
53	9.234625	9.993506	9.241118	10.758882	7
54	9.235349	9.993484	9.241865	10.758135	6
55	9.236073	9.993462	9.242610	10.757390	5
56	9.236795	9.993440	9.243354	10.756646	4
57	9.237515	9.993418	9.244097	10.755903	3
58	9.238835	9.993396	9.244839	10.755161	2
59	9.238952	9.993374	9.245579	10.754421	1
60	9.239670	9.993351	9.246319	10.753681	0
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 80.

Degree 10.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	M
0	9.239670	9.993351	9.246319	10.753681	60
1	9.240386	9.993329	9.247057	10.752943	59
2	9.241101	9.993307	9.247794	10.752206	58
3	9.241814	9.993284	9.248530	10.751470	57
4	9.242526	9.993262	9.249264	10.750736	56
5	9.243237	9.993240	9.249998	10.750002	55
6	9.243947	9.993117	9.250730	10.749270	54
7	9.244656	9.993195	9.251461	10.748539	53
8	9.245363	9.993172	9.252191	10.747809	52
9	9.246070	9.993149	9.252920	10.747680	51
10	9.246775	9.993127	9.253648	10.746352	50
11	9.247478	9.993104	9.254374	10.745626	49
12	9.248181	9.993011	9.255200	10.744900	48
13	9.248883	9.993059	9.255824	10.744176	47
14	9.249583	9.993036	9.256547	10.743453	46
15	9.250282	9.993013	9.257269	10.742731	45
16	9.250980	9.992990	9.257990	10.742010	44
17	9.251677	9.992967	9.258710	10.741290	43
18	9.252373	9.992944	9.259429	10.740571	42
19	9.253067	9.992921	9.260146	10.739854	41
20	9.253761	9.992898	9.260863	10.739137	40
21	9.254453	9.992875	9.261578	10.738422	39
22	9.255144	9.992852	9.262292	10.737708	38
23	9.255834	9.992829	9.263005	10.736995	37
24	9.256523	9.992806	9.263717	10.736283	36
25	9.257211	9.992783	9.264428	10.735572	35
26	9.257897	9.992759	9.265138	10.734865	34
27	9.258583	9.992736	9.265847	10.734153	33
28	9.259268	9.992713	9.266555	10.733445	32
29	9.259951	9.992690	9.267261	10.732739	31
30	9.260633	9.992666	9.267967	10.732033	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 79.

Degree 10.

M	Sine	Co-sine		Tangent	Co-tang.	
30	9.260633	9.992666		9.267967	10.732033	30
31	9.261314	9.992643		9.268671	10.731329	29
32	9 261994	9 992616		9.269375	10.730625	28
33	9.262673	9.992596		9.270778	10.729923	27
34	9.263351	9.992572		9.271479	10.729221	26
35	9.264027	9.992549		9.271479	10.728521	25
36	9.264703	9.992525		9.272178	10.727822	24
37	9.265378	9.992501		9.272876	10.727124	23
38	9.266051	9.992478		9.273573	10.726427	22
39	9.266723	9.992454		9 274269	10.725731	21
40	9.267395	9.992430		9.274964	10 725036	20
41	9.268065	9.992406		9.275658	10.724342	19
42	9.268734	9.992382		9.276351	10.723649	18
43	9.269402	9.992362		9.277043	10.722957	17
44	9.270069	9.902335		9.277734	10.722267	16
45	9.270735	9.992311		9.278424	10.721576	15
46	9.271400	9.992287		9.279113	10.720887	14
47	9.272063	9.992263		9.279801	10.720199	13
48	9.272726	9.992239		9.280488	10.719512	12
49	9.273388	9.992214		9.281174	10.718826	11
50	9.274049	9.992190		9.281858	10 718142	10
51	9.274708	9.992166		9.282542	10.717458	9
52	9.275367	9.992142		9.283225	10.716775	8
53	9.276025	9.992118		9.283907	10.716093	7
54	9.276681	9.992093		9 284588	10.715412	6
55	9 277337	9.992069		9 285268	10.714732	5
56	9.277991	9.992045		9.285946	10.714053	4
57	9.278685	9.99202		9.286624	10.713376	3
58	9.279297	9.991996		9.287301	10.712699	2
59	9.279948	9.991971		9.287977	10.712023	
60	9.280599	9.991947		9.288652	10.711348	0
	Co-sine	Sine		Co-tang	Tangent	M

Degree 79.

Degree 11.

M	Sine	Co-ſine		Tangent	Co-tang.	
0	9.280599	9.991947		9.288652	10.711348	60
1	9.281229	9.991922		9.289326	10.710674	59
2	9.281897	9.991897		9.289999	10.710001	58
3	9.282544	9.991873		9.290671	10.709329	57
4	9.283190	9.991848		9.291342	10.708658	56
5	9.283836	9.991823		9.292013	10.707987	55
6	9.284480	9.991799		9.292682	10.707318	54
7	9.285124	9.991774		9.293350	10.706650	53
8	9.285766	9.991749		9.294017	10.705983	52
9	9.286408	9.991724		9.294684	10.705316	51
10	9.287048	9.991699		9.295349	10.704651	50
11	9.287688	9.991674		9.296013	10.703987	49
12	9.288326	9.991649		9.296677	10.703323	48
13	9.288964	9.991624		9.297339	10.702661	47
14	9.289600	9.991599		9.298001	10.701999	46
15	9.290236	9.991574		9.298662	10.701338	45
16	9.290870	9.991549		9.299322	10.700678	44
17	9.291504	9.991524		9.299980	10.700020	43
18	9.292137	9.991498		9.300638	10.699362	42
19	9.292768	9.991473		9.301295	10.698705	41
20	9.293399	9.991448		9.301951	10.698049	40
21	9.294029	9.991422		9.302607	10.697393	39
22	9.294658	9.991397		9.303261	10.696739	38
23	9.295286	9.991372		9.303914	10.696086	37
24	9.295913	9.991346		9.304567	10.695433	36
25	9.296539	9.991321		9.305218	10.694782	35
26	9.297164	9.991295		9.305867	10.694131	34
27	9.297788	9.991270		9.306519	10.693481	33
28	9.298412	9.991244		9.307168	10.692832	32
29	9.299034	9.991218		9.307816	10.692184	31
30	9.299655	9.991193		9.308463	10.691537	30
	Co-ſine	Sine		Co-tang.	Tangent.	M

Degree 78.

Degree 11.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
30	9.299655	9.991193	9.308463	10.691537	30
31	9,300276	9,991167	9,309109	10,690891	29
32	9,300895	9,991141	9,309754	10,690246	28
33	9,301514	9,991115	9,310399	10,689601	27
34	9,302132	9,991090	9,311042	10,688958	26
35	9,302749	9,991064	9,311685	10,688315	25
36	9,303364	9,991038	9,312327	10,687673	24
37	9,303979	9,991012	9,312968	10,687032	23
38	9,304593	9,990986	9,313608	10,686392	22
39	9,305207	9,990960	9,314247	10,685753	21
40	9,305819	9,990934	9,314885	10,685115	20
41	9,306430	9,990908	9,315523	10,684477	19
42	9,307041	9,990882	9,316159	10,683841	18
43	9,307650	9,990855	9,316795	10,683205	17
44	9,308259	9,990829	9,317430	10,682570	16
45	9,308867	9,990803	9,318064	10,681936	15
46	9,309474	9,990777	9,318697	10,681303	14
47	9,310080	9,990750	9,319330	10,680670	13
48	9,310685	9,990724	9,319961	10,680039	12
49	9,311289	9,990697	9,320592	10,679408	11
50	9,311899	9,990671	9,321222	10,678778	10
51	9,312495	9,990645	9,321851	10,678149	9
52	9,313097	9,990618	9,322479	10,677521	8
53	9,313698	9,990591	9,323106	10,676894	7
54	9,314297	9.990565	9,323733	10,676267	6
55	9,314897	9,990538	9,324358	10,675642	5
56	9,315495	9,990512	9,324983	10,675017	4
57	9,316092	9,990485	9,325607	10,674393	3
58	9,316689	9,990458	9,326231	10,673769	2
59	9,317284	9,990431	9,326853	10,673147	1
60	9,317879	9,990404	9,327475	10,672525	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 78.

Degree 12.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.317879	9.990404	9.327475	10.672525	60
1	9.318473	9.990377	9.328095	10.671905	59
2	9.319066	9.990351	9.328715	10.671285	58
3	9.319658	9.990324	9.329334	10.670656	57
4	9.320250	9.990297	9.329953	10.670047	56
5	9.320840	9.990270	9.320570	10.669430	55
6	9.321430	9.990242	9.331187	10.668823	54
7	9.322019	9.990215	9.331803	10.668197	53
8	9.322607	9.990188	9.332418	10.667582	52
9	9.323194	9.990161	9.333033	10.666967	51
10	9.323780	9.990134	9.333646	10.666354	50
11	9.324366	9.990107	9.334259	10.665741	49
12	9.324950	9.990079	9.334871	10.665129	48
13	9.325534	9.990052	9.335482	10.664518	47
14	9.326117	9.990025	9.336093	10.663907	46
15	9.326699	9.989997	9.336702	10.663298	45
16	9.327281	9.989970	9.337311	10.662689	44
17	9.327862	9.989942	9.337919	10.662081	43
18	9.328441	9.989915	9.338527	10.661473	42
19	9.329020	9.989887	9.339133	10.660867	41
20	9.329599	9.989860	9.339739	10.660261	40
21	9.330176	9.989832	9.340344	10.659656	39
22	9.330753	9.989804	9.340948	10.659052	38
23	9.331328	9.989777	9.341552	10.658448	37
24	9.331903	9.989749	9.342155	10.657845	36
25	9.332478	9.989721	9.342757	10.657243	35
26	9.333051	9.989693	9.343358	10.656642	34
27	9.333624	9.989665	9.343958	10.656042	33
28	9.334195	9.989637	9.344554	10.655442	32
29	9.334766	9.989609	9.345157	10.654843	31
30	9.335337	9.989581	9.345755	10.654245	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 77.

Degree 12.

M	Sine	Co-ſine	Tangent	Co.tang.	
30	9.335337	9.989581	9.345755	10.654245	30
31	9.335906	9.989553	9.346353	10.653647	29
32	9.336475	9.989525	9.346949	10.653051	28
33	9.337043	9.989597	9.347545	10.652455	27
34	9.337610	9.989469	9.348141	10.651859	26
35	9.338176	9.989441	9.348735	10.651265	25
36	9.338742	9.989413	9.349329	10.650671	24
37	9.339306	9.989384	9.349922	10.650078	23
38	9.339870	9.989356	9.350514	10.649486	22
39	9.340434	9.989328	9.351106	10.648894	21
40	9.340996	9.989299	9.351697	10.648303	20
41	9.341558	9.989271	9.352287	10.647713	19
42	9.342119	9.989243	9.352876	10.647124	18
43	9.342679	9.989214	9.353465	10.646535	17
44	9.343239	9.98918	9.354053	10.645947	16
45	9.343797	9.989157	9.354640	10.645360	15
46	9.344355	9.989128	9.355227	10.644773	14
47	9.344912	9.989100	9.355812	10.644187	13
48	9.345469	9.989071	9.356398	10.643602	12
49	9.346024	9.989042	9.356982	10.643018	11
50	9.346579	9.989014	9.357566	10.642434	10
51	9.347134	9.988985	9.358149	10.641851	9
52	9.347687	9.988956	9.358731	10.641269	8
53	9.348240	9.988927	9.359313	10.640687	7
54	9.348792	9.988898	9.359893	10.640107	6
55	9.349343	9.988869	9.360474	10.639526	5
56	9.349893	9.988840	9.361053	10.638947	4
57	9.350443	9.988811	9.361632	10.638369	3
58	9.350992	9.988782	9.362210	10.637790	2
59	9.351540	9.988754	9.362787	10.637213	1
60	9.352088	9.988724	9.363364	10.636636	0
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 77.

Degree 13.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.352088	9.988724	9.363364	10.636636	60
1	9.352635	9.988695	9.363940	10.636060	59
2	9.353181	9.988666	9.364515	10.635485	58
3	9.353726	9.988636	9.365090	10.634910	57
4	9.354271	9.988607	9.365664	10.634336	56
5	9.354185	9.988578	9.366237	10.633763	55
6	9.355358	9.988548	9.366810	10.633190	54
7	9.355901	9.988519	9.367382	10.632618	53
8	9.356443	9.988489	9.367953	10.632047	52
9	9.356984	9.988460	9.368524	10.631476	51
10	9.357524	9.988430	9.369094	10.630906	50
11	9.358064	9.988401	9.369663	10.630337	49
12	9.358603	9.988371	9.370232	10.629768	48
13	9.359141	9.988341	9.370799	10.629201	47
14	9.359679	9.988312	9.371367	10.628633	46
15	9.350215	9.988282	9.371933	10.628067	45
16	9.360752	9.988252	9.372499	10.627501	44
17	9.361287	9.988223	9.373064	10.626936	43
18	9.361822	9.988193	9.373629	10.626371	42
19	9.362356	9.988163	9.374193	10.625807	41
20	9.362889	9.988133	9.374756	10.625244	40
21	9.363422	9.988103	9.375319	10.624681	39
22	9.363954	9.988073	9.375881	10.624116	38
23	9.364485	9.988043	9.376442	10.623558	37
24	9.365016	9.988013	9.377003	10.622997	36
25	9.365546	9.987983	9.377563	10.622437	35
26	9.366075	9.987953	9.378122	10,621878	34
27	9.366604	9.987922	9.378681	10,621319	33
28	9.367132	9.987892	9.379239	10,620761	32
29	9.367659	9.987862	9.379797	10,620203	31
30	9.368185	9.987832	9.380354	10,619646	30
	Co-sine	Sine	*Co-tang.*	Tangent	

Degree 76.

Degree 13.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.368185	9.987832	9.380354	10.619646	30
31	9.368711	9.987801	9.380910	10.619090	29
32	9.369236	9.987771	9.381466	10.618534	28
33	9.369761	9.987740	9.382021	10.617980	27
34	9.370285	9.987710	9.382575	10.617425	26
35	9.370808	9.987679	9.383129	10.616871	2
36	9.371330	9.987649	9.383682	10.616318	24
37	9.371852	9.987618	9.384234	10.615766	2
38	9.372373	9.987588	9.384786	10.615214	22
39	9.372894	9.987557	9.385337	10.614663	21
40	9.373414	9.987526	9.385888	10.614112	20
41	9.373933	9.987496	9.386438	10.613562	19
42	9.374452	9.987465	9.386987	10.613013	18
43	9.374970	9.987434	9.387536	10.612464	17
44	9.375487	9 987403	9.388084	10.611916	16
45	9.376003	9.987372	9 388631	10.611369	15
46	9.376519	9.987341	9.389178	10.610822	14
47	9.377035	9.987310	9.389724	10.610276	13
48	9.377549	9.987279	9.390270	10.609730	12
49	9.378063	9.987248	9.390815	10 609185	11
50	9.378577	9.987217	9.391360	10.608640	10
51	9.379089	9.987186	9.391907	10.608097	9
52	9.379601	9.987155	9.392467	10.607553	8
53	9.380113	9.987124	9.392989	10.607011	7
54	9.380624	9.987092	9.393531	10.606469	6
55	9.381134	9.987061	9 394074	10.605927	5
56	9.381643	9.987030	9.394614	10.605386	4
57	9.382152	9.986998	9.395154	10.604846	3
58	9.382661	9.986967	9.395694	10.604306	2
59	9.383168	9.986936	9.396233	10.603767	1
60	9.383675	9.986904	9 396771	10.603229	0
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 76.

Degree 14.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9.383675	9.986904	9.396771	10.603229	60
1	9.384181	9.986873	9.397309	10.602694	59
2	9.384687	9.986841	9.397846	10.602154	58
3	9.385192	9.986809	9.398383	10.601617	57
4	9.385697	9.986778	9.398919	10.601081	56
5	9.386201	9.986746	9.399455	10.600545	55
6	9.386704	9.986714	9.399990	10.600010	54
7	9.387207	9.986683	9.400524	10.599476	53
8	9.387709	9.986651	9.401058	10.598942	52
9	9.388210	9.986619	9.401591	10.598409	51
10	9.388711	9.986587	9.402124	10.597876	50
11	9.389211	9.986555	9.402656	10.597344	49
12	9.389711	9.986523	9.403187	10.596813	48
13	9.390210	9.986491	9.403718	10.596282	47
14	9.390708	9.986459	9.404249	10.595751	46
15	9.391206	9.986427	9.404778	10.595222	45
16	9.391703	9.986395	9.405306	10.594692	44
17	9.392199	9.986363	9.405836	10.594164	43
18	9.392695	9.986331	9.406364	10.593636	42
19	9.393190	9.986299	9.406892	10.593608	41
20	9.393685	9.986266	9.407419	10.592581	40
21	9.394179	9.986234	9.407945	10.592055	39
22	9.394673	9.986201	9.408471	10.591529	38
23	9.395166	9.986169	9.408996	10.591001	37
24	9.395654	9.986137	9.409521	10.590479	36
25	9.396150	9.986104	9.410045	10.599954	35
26	9.396641	9.986072	9.410569	10.589431	34
27	9.397131	9.986039	9.411092	10.588908	33
28	9.397621	9.086007	9.411615	10.588385	32
29	9.398111	9.985974	9.412137	10.587863	31
30	9.398600	9.985942	9.412658	10.587342	30
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 75.

Degree 14.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.398600	9.985942	9.412658	10.587342	30
31	9.399087	9.985909	9.413179	10.586821	29
32	9.399575	9.985876	9.413699	10.586301	28
33	9.400062	9.985843	9.414219	10.585781	27
34	9.400549	9.985811	9.414738	10.585262	26
35	9.401035	9.985778	9.415257	10.584742	25
36	9.401520	9.985745	9.415775	10.584225	24
37	9.402005	9.985712	9.416293	10.583707	23
38	9.402489	9.985679	9.416810	10.583190	22
39	9.402972	9.985646	9.417326	10.582674	21
40	9.403455	9.985613	9.417842	10.582157	20
41	9.403938	9.985580	9.418357	10.581642	19
42	9.404420	9.985547	9.418873	10.581127	18
43	9.404901	9.985513	9.419387	10.580613	17
44	9.405382	9.985480	9.419901	10.580099	16
45	9.405862	9.985447	9.420415	10.579585	15
46	9.406341	9.985414	9.420927	10.579072	14
47	9.406820	9.985380	9.421440	10.578560	13
48	9.407299	9.985347	9.421951	10.578048	12
49	9.407776	9.985314	9.422463	10.577537	11
50	9.408254	9.985280	9.422973	10.577026	10
51	9.408731	9.985247	9.423484	10.576516	9
52	9.409207	9.985213	9.423993	10.576007	8
53	9.409682	9.985180	9.424503	10.575497	7
54	9.410157	9.985146	9.425011	10.574989	6
55	9.410632	9.985112	9.425518	10.574480	5
56	9.411106	9.985079	9.426027	10.573973	4
57	9.411579	9.985045	9.426534	10.573466	3
58	9.412052	9.985011	9.427041	10.572959	2
59	9.412524	9.984977	9.427547	10.572453	1
60	9.412996	9.984943	9.428052	10.571947	0
	Co-ſine	Sine	Co-tang	Tangent	M

Degree 75.

Degree 15.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9.412996	9.984944	9.428052	10.571947	60
1	9.413467	9.984910	9.428557	10.571442	59
2	9.413938	9.984876	9.429062	10.570938	58
3	9.414408	9.984842	9.429566	10.570434	57
4	9.414878	9.984808	9.420070	10.579930	56
5	9.415347	9.984774	9.420573	10.579427	55
6	9.415815	9.984740	9.431075	10.568925	54
7	9.416283	9.984706	9.431577	10.568423	53
8	9.416850	9.984672	9.432079	10.567921	52
9	9.417217	9.984637	9.432580	10.567420	51
10	9.417684	9.984603	9.433080	10.566920	50
11	9.418149	9.984569	9.433580	10.566419	49
12	9.418615	9.984535	9.434080	10.565920	48
13	9.419079	9.984500	9.434579	10.565421	47
14	9.419544	9.984466	9.435078	10.564922	46
15	9.420007	9.984431	9 435576	10.564424	45
16	9.420470	9.984397	9.436073	10.563927	44
17	9.420933	9.984363	9.436570	10.563430	43
18	9.421395	9.984328	9.437067	10.562933	42
19	9.421856	9.984293	9.437563	10.562437	41
20	9.422317	9.984259	9.438059	10.561941	40
21	9.422778	9.984224	9 439554	10.561446	39
22	9.423238	9.984189	9.439548	10.560952	38
23	9.423697	9.984155	9.439543	10.560457	37
24	9.424156	9.984120	9.440036	10.559964	36
25	9 424615	9 984085	9.440529	10.559471	35
26	9.425072	9.984050	9.441022	10.558978	34
27	9.425530	9.984015	9.441514	10.558486	33
28	9.425987	9.983980	9.441006	10.557994	32
29	9.426443	9.983945	9.442497	10.557503	31
30	9.426899	9.983910	9.442988	10.557011	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 74.

Degree 15.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
30	9.426899	9.983910	9.442988	10.557011	30
31	9.427354	9.983875	9.443479	10.556521	29
32	9.427809	9.983840	9.443968	10.556031	28
33	9.428264	9.983805	9.444458	10.555542	27
34	9.428717	9.983770	9.444947	10.555053	26
35	9.429170	9.983735	9.445435	10.554565	25
36	9.429623	9.983699	9.445923	10.554077	24
37	9.430075	9.983664	9.446411	10.553589	23
38	9.430507	9.983629	9.446898	10.553102	22
39	9.430978	9.983593	9.447384	10.352616	21
40	9.431429	9.983558	9.447870	10.552129	20
41	9.431879	9.983523	9.448356	10.551644	19
42	9.432328	9.983487	9.448841	10.551159	18
43	9.432778	9.983452	9.449326	10.550674	17
44	9.433206	9.983416	9.449870	10.550181	16
45	9.433674	9.983380	9.450294	10.559706	15
46	9.434122	9.983345	9.450777	10.549223	14
47	9.434569	9.983309	9.451260	10.548740	13
48	9.435016	9.983273	9.451743	10.548257	12
49	9.435462	9.983238	9.452225	10.547775	11
50	9.435918	9.983202	9.452706	10.547294	10
51	9.436353	9.983166	9.453187	10.546813	9
52	9.436798	9.983130	9.453668	10.546332	8
53	9.437242	9.983094	9.454148	10.545852	7
54	9.437686	9.983058	9.454625	10.545372	6
55	9.438129	9.983022	9.455107	10.544893	5
56	9.438572	9.982986	9.455586	10.544414	4
57	9.439014	9.982950	9.456064	10.543936	3
58	9.439456	9.982914	9.456542	10.543458	2
59	9.439897	9.982878	9.457019	10.542980	1
60	9.430338	9.982842	9.457496	10.542503	0
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 74.

Degree 16.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.440338	9.982842	9.457496	10.542503	60
1	9.440778	9.982805	9.457973	10.542027	59
2	9.441218	9.982769	9.458449	10.541551	58
3	9.441658	9.982733	9.458925	10.541075	57
4	9.442096	9.982696	9.459400	10.540600	56
5	9.442535	9.982660	9.459875	10.540125	55
6	9.442973	9.982623	9.460349	10.539651	54
7	9.443416	9.982587	9.460829	10.539177	53
8	9.443848	9.982550	9.461297	10.538703	52
9	9.444284	9.982514	9.461770	10.538230	51
10	9.444720	9.982477	9.462242	10.537758	50
11	9.445155	9.982441	9.462714	10.537285	49
12	9.445590	9.982404	9.463186	10.536814	48
13	9.446025	9.982367	9.463658	10.536342	47
14	9.446459	9.982330	9.464129	10.535871	46
15	9.446893	9.982294	9.464599	10.535401	45
16	9.447326	9.982257	9.465069	10.534931	44
17	9.447759	9.982220	9.465539	10.534461	43
18	9.448191	9.982183	9.466008	10.533992	42
19	9.448623	9.982146	9.466476	10.533523	41
20	9.449054	9.982109	9.466945	10.533055	40
21	9.449485	9.982072	9.467413	10.532587	39
22	9.449915	9.982035	9.467880	10.532120	38
23	9.440345	9.981998	9.468347	10.531653	37
24	9.440775	9.981961	9.468814	10.531186	36
25	9.441203	9.981923	9.469280	10.530720	35
26	9.451637	9.981886	9.469746	10.530254	34
27	9.452060	9.981849	9.470211	10.529789	33
28	9.452488	9.981812	9.470676	10.529324	32
29	9.452915	9.981774	9.471141	10.528859	31
30	9.453342	9.981737	9.471605	10.528395	30
	Co-sine	Sine	*Co-tang.*	Tangent	

Degree 73.

Degree 16.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.453342	9.981737	9.471605	10.528395	30
31	9.453768	9.981699	9.472068	10.527931	29
32	9.454194	9.981662	9.472522	10.527468	28
33	9.454619	9.981624	9.472995	10.527005	27
34	9.455044	9.981587	9.473457	10.526543	26
35	9.455469	9.981549	9.473919	10.526081	25
36	9.455892	9.981512	9.474381	10.525619	24
37	9.456316	9.981474	9.474842	10.525158	23
38	9.456739	9.981436	9.475303	10.524695	22
39	9.457162	9.981398	9.475763	10.524237	21
40	9.457584	9.981361	9.476223	10.523777	20
41	9.458006	9.981323	9.476683	10.523317	19
42	9.458427	9.981285	9.477142	10.522858	18
43	9.458840	9.981247	9.477601	10.522399	17
44	9.459268	9.981209	9.478059	10.521941	16
45	9.459684	9.981171	9.478517	10.521483	15
46	9.460108	9.981133	9.478975	10.521025	14
47	9.460527	9.981095	9.479432	10.520568	13
48	9.460946	9.981057	9.479889	10.520111	12
49	9.461364	9.981019	9.480345	10.519655	11
50	9.461782	9.980980	9.480801	10.519199	10
51	9.462199	9.980942	9.481257	10.518743	9
52	9.462616	9.980904	9.481712	10.518288	8
53	9.463032	9.980866	9.482167	10.517833	7
54	9.463448	9.980827	9.482621	10.517379	6
55	9.463864	9.980789	9.483075	10.516925	5
56	9.464279	9.980750	9.483528	10.516471	4
57	9.464694	9.980712	9.483982	10.516018	3
58	9.465108	9.980672	9.484434	10.515565	2
59	9.465522	9.980635	9.484887	10.515113	1
60	9.465935	9.980596	9.485339	10.514661	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 73.

Degree 17.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.465935	9.980596	9.485339	10.514668	60
1	9,466348	9,980558	9,485791	10,514209	59
2	9,466761	9,980519	9,486242	10,513758	58
3	9,467173	9,980480	9,486693	10,513307	57
4	9,467585	9,980441	9,487143	10,512857	56
5	9,467996	9,980403	9,487593	10,512407	55
6	9,468407	9,980364	9,488043	10,511957	54
7	9,468817	9,980325	9,488493	10,511507	53
8	9,469227	9,980286	9,488941	10,511059	52
9	9,469637	9,980247	9,489390	10,510610	51
10	9,469446	9,980208	9,489838	10,510162	50
11	9,470455	9,980169	9,490286	10,509714	49
12	9,471863	9,980130	9,490733	10,509267	48
13	9,471071	9,980091	9,491180	10,508820	47
14	9,471678	9,980052	9,491627	10,508373	46
15	9,472086	9,980012	9,492073	10,507928	45
16	9,472492	9,979973	9,492519	10,507481	44
17	9,472898	9,979934	9,492964	10,507035	43
18	9,473304	9,979894	9,493410	10,506590	42
19	9,473710	9,979855	9,493854	10,506145	41
20	9,474115	9,979816	9,494299	10,505701	40
21	9,474519	9,979776	9,494743	10,50525	39
22	9,474923	9,979737	9,495180	10,504813	38
23	9,475327	9,979697	9,49563	10,504370	37
24	9,475730	9,979658	9,496073	10,503928	36
25	9,476133	9,979618	9,496515	10,503485	35
26	9,476536	9,979578	9,496957	10,503043	34
27	9,476938	9,979539	9,497399	10,502601	33
28	9,477340	9,979499	9,497840	10,502160	32
29	9,477741	9,979459	9,498282	10,501718	31
30	9,478142	9,9794 9	9,498722	10,501278	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 72.

Degree 17.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.478142	9.979419	9.498722	10.501278	30
31	9.478542	9.979380	9.499163	10.500837	29
32	9.478942	9.979349	9.499602	10.500398	28
33	9.479342	9.979309	9.500042	10.499958	27
34	9.479741	9.979260	9.500481	10.499519	26
35	9.480140	9.979220	9.500920	10.499080	25
36	9.480538	9.979180	9.501359	10.498641	24
37	9.480936	9.979140	9.501797	10.498203	23
38	9.481334	9.979099	9.502234	10.497765	22
39	9.481731	9.979059	9.502672	10.497328	21
40	9.482128	9.979019	9.503109	10.496891	20
41	9.482525	9.978980	9.503546	10.496454	19
42	9.482921	9.978939	9.503982	10.496018	18
43	9.483316	9.978898	9.504418	10.495582	17
44	9.483711	9.978858	9.504854	10.495146	16
45	9.484106	9.978817	9.505289	10.494711	15
46	9.484501	9.978777	9.505724	10.494216	14
47	9.484895	9.978736	9.506158	10.493841	13
48	9.485289	9.978696	9.506593	10.493407	12
49	9.485682	9.978655	9.507026	10.492973	11
50	9.486075	9.978615	9.507459	10.492540	10
51	9.486467	9.978574	9.507892	10.492107	9
52	9.486859	9.978533	9.508326	10.491674	8
53	9.487251	9.978493	9.508759	10.491241	7
54	9.487642	9.978452	9.509181	10.490809	6
55	9.488033	9.978411	9.509622	10.490377	5
56	9.488424	9.978370	9.510044	0.489946	4
57	9.488814	9.978329	9.510486	10.489515	3
58	9.489204	9.978288	9.510916	10.489084	2
59	9.489593	9.978247	9.511346	10.489654	1
60	9.489982	9.978206	9.511776	10.488225	0
	Co-ſine	Sine	*Co-tang.*	Tangent.	M

Degree 72.

Degree 18.

M	Sine	Co-sine	Tangent	Co-tang.	M
0	9.489982	9.978206	9.511776	10.488224	60
1	9.490371	9.978165	9.512206	10.487794	59
2	9.490759	9.978124	9.512635	10.487365	58
3	9.491147	9.978083	9.513064	10.486936	57
4	9.491534	9.978042	9.513493	10.486507	56
5	9.491922	9.978000	9.513921	10.486079	55
6	9.492308	9.977959	9.514349	10.485651	54
7	9.492695	9.977918	9.514777	10.485223	53
8	9.493080	9.977877	9.515204	10.484796	52
9	9.493466	9.977835	9.515631	10.484369	51
10	9.493851	9.977794	9.516057	10.483942	50
11	9.494236	9.977752	9.516484	10.483516	49
12	9.494620	9.977711	9.516910	10.483090	48
13	9.495005	9.977669	9.517335	10.482665	47
14	9.495388	9.977628	9.517761	10.482239	46
15	9.495771	9.977586	9.518185	10.481814	45
16	9.496154	9.977544	9.518610	10.481390	44
17	9.496537	9.977503	9.519034	0.480966	43
18	9.496919	9.977461	9.519458	10.480542	42
19	9.497301	9.977419	9.519882	10.480118	41
20	9.497682	9.977377	9.520305	10.489695	40
21	9.498063	9.977335	9.520728	10.479272	39
22	9.498444	9.977293	9.521151	10.478849	38
23	9.498824	9.977251	9.521573	10.478427	37
24	9.499204	9.977209	9.521995	10.478005	36
25	9.499584	9.977167	9.522417	10.477583	35
26	9.499963	9.977125	9.522838	10.477162	34
27	9.500342	9.977083	9.523259	10.476741	33
28	9.500720	9.977041	9.523679	10.476320	32
29	9.501099	9.977999	9.524109	10.475900	31
30	9.501476	9.977956	9.524520	10.475480	30
	Co-sine	Sine	Co-tang.	Tangent.	M

Degree 71.

Degree 18.

M	Sine	Co-sine		Tangent	Co-tang.	
30	9.501476	9.977956		9.524520	10.475480	30
31	9.501854	9.976914		9.524936	10.475060	29
32	9.502231	9.976872		9.525359	10.474641	28
33	9.502607	9.976830		9.525778	10.474222	27
34	9.502984	9.976787		9.526197	10.473803	26
35	9.503360	9.976745		9.526615	10.473385	25
36	9.503735	9.976702		9.527033	10.472967	24
37	9.504110	9.976660		9.527451	10.472549	23
38	9.504485	9.976617		9.527868	10.472132	22
39	9.504840	9.976574		9.528285	10.471715	21
40	9.505234	9.976532		9.528702	10.471298	20
41	9.505608	9.976489		9.529118	10.470881	19
42	9.505981	9.976446		9.529535	10.470465	18
43	9.506354	9.976404		9.529950	10.470049	17
44	9.506727	9.976361		9.530366	10.469634	16
45	9.507099	9.976318		9.530781	10.469219	15
46	9.507471	9.976275		9.531196	10.468804	14
47	9.507843	9.976232		9.531611	10.468389	13
48	9.508214	9.976185		9.532025	10.467975	12
49	9.508585	9.976146		9.532436	10.467566	11
50	9.508955	9.976103		9.532852	10.467147	10
51	9.509326	9.976060		9.533266	10.466734	9
52	9.509696	9.976027		9.533679	10.466321	8
53	9.510065	9.975970		9.534092	10.465908	7
54	9.510434	9.975930		9.534504	10.465496	6
55	9.510803	9.975887		9.534916	10.465084	5
56	9.511171	9.975844		9.535328	10.464672	4
57	9.511540	9.975800		9.535739	10.464261	3
58	9.511907	9.975757		9.536150	10.463849	2
59	9.512275	9.975713		9.536561	10.463439	1
60	9.512642	9.975670		9.536972	10.463028	0
	Co-sine	Sine		Co-tang	Tangent	M

Degree 71.

Degree 19.

M	Sine	*Co-sine*		Tangent	*Co-tang.*	M
0	9.512644	9.975670		9.536672	10.463028	60
1	9.513009	9.975626		9.537382	10.462618	59
2	9.513375	9.975583		9.537792	10.462208	58
3	9.513741	9.975539		9.538202	10.461798	57
4	9.514107	9.975496		9.538610	10.461389	56
5	9.514472	9.975452		9.539020	10.460980	55
6	9.514837	9.975408		9.539429	10.460571	54
7	9.515202	9.975364		9.539837	10.460163	53
8	9.515566	9.975321		9.540245	10.459755	52
9	9.515930	9.975277		9.540653	10.459347	51
10	9.516294	9.975233		9.541061	10.458939	50
11	9.516657	9.975189		9.541468	10.458532	49
12	9.517020	9.975145		9.541875	10.458125	48
13	9.517382	9.975101		9.542281	10.457719	47
14	9.517745	9.975057		9.542688	10.457312	46
15	9.518107	9.975013		9.543094	10.456906	45
16	9.518468	9.974969		9.543499	10.456501	44
17	9.518829	9.974925		9.543905	10.456095	43
18	9.519190	9.974880		9.544310	10.455690	42
19	9.519551	9.974836		9.544715	10.455285	41
20	9.519911	9.974792		9.545119	10.454881	40
21	9.520271	9.974747		9.545524	10.454476	39
22	9.520631	9.974703		9.545927	10.454072	38
23	9.520990	9.974659		9.546331	10.453669	37
24	9.521349	9.974614		9.546735	10.453265	36
25	9.521707	9.974570		9.547138	10.452862	35
26	9.522065	9.974525		9.547540	10.452459	34
27	9.522423	9.974480		9.547943	10.452057	33
28	9.522781	9.974436		9.548345	10.451655	32
29	9.523138	9.974391		9.548747	10.451253	31
30	9.523495	9.974346		9.549149	10.450851	30
	Co-sine	Sine		*Co-tang.*	Tangent	M

Degree 70.

Degree 19.

M	Sine	Co-ſine.	Tangent	Co-tang.	
30	9.523495	9.974346	9.549149	10.450851	30
31	9.523851	9.974302	9.549550	10.450450	29
32	9.524208	9.974257	9.549951	10.450049	28
33	9.524564	9.974212	9.550352	10.449648	27
34	9.524920	9.974167	9.550752	10.449248	26
35	9.525275	9.974122	9.551152	10.448848	25
36	9.525630	9.974077	9.551552	10.448448	24
37	9.525984	9.974032	9.551952	10.448048	23
38	9.526339	9.973987	9.552351	10.447649	22
39	9.526693	9.973942	9.552750	10.447250	21
40	9.527046	9.973897	9.553149	10.446951	20
41	9.527400	9.973852	9.553548	10.446452	19
42	9.527753	9.973807	9.553946	10.446054	18
43	9.528105	9.973761	9.554344	10.445656	17
44	9.528458	9.973716	9.554741	10.445259	16
45	9.528810	9.973671	9.555139	10.444861	15
46	9.529161	9.973625	9.555536	10.444464	14
47	9.529513	9.973580	9.555932	10.444068	13
48	9.529864	9.973535	9.556329	10.443671	12
49	9.530214	9.973489	9.556725	10.443275	11
50	9.530565	9.973443	9.557121	10.442879	10
51	9.530915	9.973398	9.557517	10.442483	9
52	9.531265	9.973352	9.557912	10.442088	8
53	9.531614	9.973307	9.558308	10.441693	7
54	9.531963	9.973261	9.558702	10.441298	6
55	9.532312	9.973215	9.559097	10.440903	5
56	9.532661	9.973169	9.559491	10.440509	4
57	9.533009	9.973123	9.559885	10.440115	3
58	9.533357	9.973078	9.560279	10.439721	2
59	9.533704	9.973032	9.560673	10.439327	1
60	9.534052	9.972986	9.561066	10.438934	0
	Co-ſine	Sine	Co-tang.	Tangent	

Degree 70.

Degree 20.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	M
0	9.534052	9.971986	9.561066	10.438934	60
1	9.534399	9.972940	9.561459	10.438541	59
2	9.534746	9.972894	9.561851	10.438148	58
3	9.535091	9.972848	9.562244	10.437756	57
4	9.535437	9.972801	9.562636	10.437364	56
5	9.535783	9.972755	9.563028	10.436972	55
6	9.536129	9.972709	9.563419	10.436581	54
7	9.536474	9.972663	9.563811	10.436189	53
8	9.536818	9.972617	9.564202	10.435798	52
9	9.537163	9.972570	9.564592	10.435407	51
10	9.537507	9.972524	9.564983	10.435017	50
11	9.537851	9.972477	9.565373	10.434627	49
12	9.538194	9.972431	9.565763	10.434237	48
13	9.538537	9.972384	9.566153	10.433857	47
14	9.538880	9.972338	9.566542	10.433457	46
15	9.539222	9.972291	9.566932	10.433068	45
16	9.539565	9.972245	9.567320	10.432679	44
17	9.539907	9.972198	9.567709	10.432291	43
18	9.540249	9.972151	9.568097	10.431902	42
19	9.540590	9.972105	9.568486	10.431514	41
20	9.540931	9.972058	9.569873	10.431126	40
21	9.541272	9.972011	9.569261	10.430739	39
22	9.541612	9.971964	9.56964	10.430351	38
23	9.54195	9.971917	9.560035	10.429964	37
24	9.542292	9.971870	9.560422	10.429578	36
25	9.542632	9.971823	9.560809	10.429191	35
26	9.542971	9.971776	9.571195	10.428805	34
27	9.543310	9.971729	9.571581	10.428419	33
28	9.543649	9.971682	9.571967	10.428033	32
29	9.543987	9.971635	9.572352	10.427648	31
30	9.544325	9.971588	9.572748	10.427262	30
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 69.

Degree 20.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
30	9.544325	9.971588	9.572738	10.427262	30
31	9.544663	9.971540	9.573123	10.426877	29
32	9.545000	9.971493	9.573507	10.426492	28
33	9.545338	9.971445	9.573892	10.426108	27
34	9.545674	9.971398	9.574276	10.425724	26
35	9.546011	9.971351	9.574660	10.425340	25
36	9.546347	9.971303	9.575044	10.424956	24
37	9.546683	9.971256	9.575427	10.424573	23
38	9.547019	9.971208	9.575810	10.424189	22
39	9.547354	9.971161	6.576193	10.423807	21
40	9.547689	9.971112	9.576576	10.423424	20
41	9.548024	9.971065	9.576958	10.423041	19
42	9.548358	9.971018	9.577341	10.422659	18
43	9.548693	9.970970	9.577723	10.422277	17
44	9.549026	9.970922	9.578104	10.421896	16
45	9.549360	9.970874	9.578486	10.421514	15
46	9.549693	9.970826	9.578867	10.421133	14
47	9.550026	9.970779	9.579248	10.420752	13
48	9.550359	9.970731	9.579628	10.420371	12
49	9.550692	9.970683	9.580009	10.419991	11
50	9.551024	9.970634	9.580389	10.419611	10
51	9.551355	9.970586	9.580769	10.419231	9
52	9.551687	9.970538	9.581149	10.418851	8
53	9.552018	9.970490	9.581528	10.418472	7
54	9.552349	9.970442	9.581907	10.418092	6
55	9.552680	9.970394	9.582286	10.417713	5
56	9.553010	9.970345	9.582665	10.417335	4
57	9.553340	9.970297	9.583043	10.416956	3
58	9.553670	9.970249	9.583422	10.416578	2
59	9.554000	9.970200	9.583800	10.416200	1
60	9.554329	9.970152	9.584177	10.415723	0
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 69.

Degree 21.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9,554329	9,970152	9,584177	10,415822	60
1	9,554658	9,970103	9,584555	10,415445	59
2	9,554987	9,970055	9,584932	10,415068	58
3	9,555315	9,970006	9,585308	10,414691	57
4	9,555643	9,969957	9,585686	10,414314	56
5	9,555971	9,969909	9,586062	10,413938	55
6	9,556299	9,969860	9,586439	10,413561	54
7	9,556626	9,969611	9,586815	10,413185	53
8	9,556953	9,969762	9,587190	10,412800	52
9	9,557279	9,969713	9,587566	10,412434	51
10	9,557606	9,969665	9,587941	10,412059	50
11	9,557932	9,969616	9,588316	10,411684	49
12	9,558258	9,969567	9,588691	10,411309	48
13	9,558583	9,969518	9,589066	10,410934	47
14	9,558909	9,969469	9,589440	10,410560	46
15	9,559234	9,969419	9,589814	10,410285	45
16	9,559558	9,969370	9,590188	10,409812	44
17	9,559883	9,969321	9,590561	10,409438	43
18	9,560207	9,969272	9,590935	10,409065	42
19	9,560531	9,969223	9,591308	10,408692	41
20	9,560855	9,969173	9,591681	10,408319	40
21	9,561178	9,969124	9,592054	10,407946	39
22	9,561501	9,969075	9,592426	10,407574	38
23	9,561824	9,969025	9,592798	10,407201	37
24	9,562146	9,968976	9,593170	10,406829	36
25	9,562468	9,998926	9,593542	10,406457	35
26	9,562790	9,968877	9,593914	10,406086	34
27	9,563112	9.968827	9,594285	10,405715	33
28	9,563433	9,968777	9,594656	10,405344	32
29	9,563754	9,968728	9,595027	10,405073	31
30	9,564076	9,968678	9,595397	10,404602	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 68.

Degree 21.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.564075	9.968678	9.595397	10.404602	30
31	9.564396	9.968628	9.595768	10.404232	29
32	9.564716	9.968578	9.596138	10.403862	28
33	9.565036	9.968528	9.596508	10.403492	27
34	9.565356	9.968478	9.596878	10.403122	26
35	9.565675	9.968428	9.597247	10.402753	25
36	9.565995	9.968378	9.597616	10.402384	24
37	9.566314	9.968328	9.597985	10.402015	23
38	9.566632	9.968278	9.598354	10.401646	22
39	9.566951	9.968228	9.598722	10.401277	21
40	9.567269	9.968178	9.599091	10.400909	20
41	9.567587	9.968128	9.599459	10.400541	19
42	9.567904	9.968078	9.599827	10.400173	18
43	9.568222	9.968027	9.500194	10.399806	17
44	9.568539	9.967977	9.500562	10.399438	16
45	9.568855	9.967927	9.500929	10.399071	15
46	9.569172	9.967876	9.601296	10.398704	14
47	9.569488	9.967826	9.601662	10.398337	13
48	9.569804	9.967775	9.602029	10.397971	12
49	9.570120	9.967725	9.602395	10.397605	11
50	9.570435	9.967674	9.602761	10.397239	10
51	9.570751	9.967623	9.603127	10.396873	9
52	9.571065	9.967573	9.603493	10.396507	8
53	9.571380	9.967522	9.603858	10.396142	7
54	9.571695	9.967471	9.604223	10.395777	6
55	9.572009	9.967420	9.604588	10.395412	5
56	9.572322	9.967370	9.604953	10.395047	4
57	9.572636	9.967319	9.605317	10.394683	3
58	9.572949	9.967368	9.605681	10.394318	2
59	9.573263	9.967217	9.606046	10.393954	1
60	9.573575	9.967166	9.606409	10.393590	0
	Co-ſine	Sine	*Co-tang.*	Tangent.	M

Degree 68.

Degree 22.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9.573575	9.967166	9.606409	10.393590	60
1	9.573888	9.967115	9.606773	10.393227	59
2	9.574200	9.967064	9.607136	10.392863	58
3	9.574512	9.967012	9.607500	10.392500	57
4	9.574824	9.966961	9.607862	10.392137	56
5	9.575135	9.966910	9.608225	10.391774	55
6	9.575447	9.966859	9.608588	10.391412	54
7	9.575758	9.966807	9.608950	10.391050	53
8	9.576068	9.966756	9.609312	10.390688	52
9	9.576379	9.966705	9.609674	10.390326	51
10	9.576689	9.966653	9.600036	10.399964	50
11	9.576999	9.966602	9.610397	10.389603	49
12	9.577309	9.966550	9.610758	10.389241	48
13	9.577618	9.966499	9.611119	10.388880	47
14	9.577927	9.966447	9.611480	10.388520	46
15	9.578236	9.966395	9.611840	10.388159	45
16	9.578545	9.966344	9.612201	10.387799	44
17	9.578853	9.966292	9.612561	10.387438	43
18	9.579161	9.966240	9.612921	10.387078	42
19	9.579469	9.966188	9.613281	10.386719	41
20	9.579777	9.966136	9.613641	10.386359	40
21	9.580084	9.966084	9.614000	10.386000	39
22	9.580392	9.966032	9.614359	10.385641	38
23	9.580698	9.965980	9.614718	10.385282	37
24	9.581005	9.965928	9.615077	10.384923	36
25	9.581311	9.965876	9.615435	10.384565	35
26	9.581618	9.965824	9.615793	10.384207	34
27	9.581923	9.965772	9.616151	10.383448	33
28	9.582229	9.965720	9.616509	0.383491	32
29	9.582534	9.965668	9.616867	10.383133	31
30	9.582840	9.965615	9.617224	10.382776	30
	Co-ſine	Sine	*Co-tang.*	Tangent.	M

Degree 67.

Degree 22.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.582840	9.965615	9.617224	10 382776	30
31	9.583144	9.965563	9.617581	10.382418	29
32	9.583449	9.965511	9.617938	10.382061	28
33	9.583753	9.965458	9.618295	10.381705	27
34	9.584058	9 965406	9.618652	10.381348	26
35	9.584361	9.965353	9.619008	10.380992	25
36	9.584665	9.965301	9.619364	10.380635	24
37	9.584968	9 965248	9.619720	10.380279	23
38	9.585271	9 965195	9.620076	10.379924	22
39	9.585574	9.965 43	9.620432	10.379568	21
40	9.585877	9.965090	9.620787	10.379213	20
41	9.586179	9.965037	9.621142	10.378858	19
42	9.586481	9.964984	9.621497	10.378503	18
43	9.586783	9.964931	9.621852	10.378148	17
44	9.587085	9.964878	9.622206	10.377793	16
45	9.587386	9.964825	9.622561	10.377439	15
46	9.587687	9.964772	9.622915	10.377085	14
47	9.587988	9.964719	9.623269	10.376731	13
48	9.588289	9.964666	9.623623	10,376377	12
49	9.588589	9.964613	9.623976	10.376024	11
50	9.588890	9.964560	9.624330	10.375670	10
51	9.589190	9.964507	9 624683	10.375317	9
52	9.589489	9.964454	9.625036	10.374964	8
53	9.589789	9.964400	9.625388	10.374612	7
54	9.590088	9 964347	9.625741	10.374259	6
55	9.590387	9.964294	9.626093	10.373907	5
56	9.590686	9.964240	9.626445	10.373555	4
57	9.590984	9.964187	9.626797	10 373203	3
58	9 591282	9.964133	9 627149	10.372850	2
59	9.591580	9.964080	9.627501	10.372499	1
60	9.591878	9.964026	9.627852	10.372148	0
	Co-ſine	Sine	*Co-tang*	Tangent	M

Degree 67.

Degree 23.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.591878	9.964026	9.627852	10.372148	60
1	9.592175	9.963972	9.628203	10.371797	59
2	9.592473	9.963919	9.628554	10.371446	58
3	9.592770	9.963865	9.628905	10.371095	57
4	9.593067	9.963811	9.629255	10.370744	56
5	9.593363	9.963757	9.629606	10.370394	55
6	9.593658	9.963703	9.629956	10.370044	54
7	9.593955	9.963650	9.630306	10.369694	53
8	9.594251	9.963596	9.630655	10.369344	52
9	9.594547	9.963542	9.631005	10.368995	51
10	9.594842	9.963488	9.631354	10.368645	50
11	9.595137	9.963433	9.631704	10.368296	49
12	9.595432	9.963379	9.632053	10.367947	48
13	9.595727	9.963325	9.632401	10.367598	47
14	9.596021	9.963271	9.632750	10,367250	46
15	9.596315	9.963217	9.633098	10.366901	45
16	9.596610	9.963102	9.633447	10.366553	44
17	9.596903	9.963108	9.633795	10.366205	43
18	9.597196	9.963054	9.634143	10.365857	42
19	9.597490	9.962999	9.634490	10.365510	41
20	9.597783	9.962945	9.634838	10.365162	40
21	9.598075	9.962892	9.635185	10.364815	39
22	9.598368	9.962836	9.635530	10.364468	38
23	9.598660	9.962781	9 635879	10.364121	37
24	9.598952	9 962726	9.636226	10.363774	36
25	9.599244	9.962572	9.636572	10.363428	35
26	9.59953[illegible]	9.962617	9.636918	10.363081	34
27	9.599827	9.962562	9.637205	10 362735	33
28	9.600118	9.962507	9.637610	10.362389	32
29	9.600409	9.962453	9.637956	10.362044	31
30	9.600700	9.962398	9.638302	10.361698	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 66.

Degree 23.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
30	9.600700	9.962398	9.638302	10.361698	30
31	9.600990	9.962343	9.638647	10.361353	29
32	9.601280	9.962288	9.638992	10.361007	28
33	9.601570	9.962233	9.639337	10.360662	27
34	9.601860	9.962178	9.639682	10.360318	26
35	9.602149	9.962122	9.640027	10.369973	25
36	9.602439	9.962067	9.640371	10.359624	24
37	9.602728	9.962012	9.640716	10.359284	23
38	9.603017	9.961957	9.641060	10.358940	22
39	9.603305	9.961902	9.641404	10.358596	21
40	9.603594	9.961846	9.641747	10.358253	20
41	9.603882	9.961791	9.642091	10.357909	19
42	9.604170	9.961735	9.642434	10.357566	18
43	9.604457	9.961680	9.642777	10.357222	17
44	9.604745	9.961624	9.643120	10.356980	16
45	9.605032	9.961569	9.643463	10.356537	15
46	9.605319	9.961513	9.643806	10.356194	14
47	9.605606	9.961458	9.644148	10.355852	13
48	9.605892	9.961402	9.644490	10.355510	12
49	9.606179	9.961346	9.644832	10.355168	11
50	9.606465	9.961290	9.645174	10.354826	10
51	9.606750	9.961235	9.645516	10.354484	9
52	9.607036	9.961179	9.645857	10.554142	8
53	9.607322	9.961123	9.646199	10.353801	7
54	9.607607	9.961067	9.646540	10.353460	6
55	9.607892	9.961011	9.646881	10.353119	5
56	9.608176	9.960955	9.647222	10.352778	4
57	9.608461	9.960899	9.647562	10.352438	3
58	9.608745	9.960842	9.647903	10.352097	2
59	9.609029	9.960785	9.648243	10.351757	1
60	9.609313	9.960730	9.648583	10.351417	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 66.

Degree 24.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9.609313	9.960730	9.648583	10.351417	60
1	9.609597	9.960674	9.648923	10.351077	59
2	9.609880	9.960617	9.649263	10.35 737	58
3	9.610163	9.960561	9.649602	10.350398	57
4	9.610446	9.960505	9.649942	10.350058	56
5	9.610729	9.960448	9.650281	10.349719	55
6	9.611012	9.960392	9.650620	10.349380	54
7	9.611294	9.960335	9.650959	10.349041	53
8	9.611576	9.960279	9.651297	10.348703	52
9	9.611858	9.960222	9.65163	10.348364	51
10	9.612140	9.960165	9.651974	10.348026	50
11	9.612421	9.960109	9.652312	10.347688	49
12	9.612702	9.960052	9.652650	10.347350	48
13	9.612983	9.959995	9.652988	10.347012	47
14	9.613264	9.959938	9.653326	10.346674	46
15	9.613545	9.959881	9.653663	10.346337	45
16	9.613825	9.959824	9.654000	10.345999	44
17	9.614105	9.959768	9.654337	10.345662	43
18	9.614385	9.959710	9.654674	10.345325	42
19	9.614665	9.959653	9.655011	10.344989	41
20	9.614944	9.959596	9.655348	10.344652	40
21	9.615223	9.959539	9.655684	10.344316	39
22	9.615502	9.959482	9.656020	10.343980	38
23	9.615781	9.959425	9.656356	10.343643	37
24	9.616060	9.959367	9.656692	10.343308	36
25	9.616338	9.959310	9.657028	10.342972	35
26	9.616616	9.959253	9.657363	10.342636	34
27	9.616894	9.959195	9.657699	10.342301	33
28	9.617172	9.959138	9.658034	10.341966	32
29	9.617450	9.959080	9.658369	10.341531	31
30	9.617727	9.959023	9.658704	10.341296	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 65.

Degree 24.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.617727	9.959023	9.658704	10.341296	30
31	9.618004	9.958965	9.659039	10.340926	29
32	9.618281	9.958908	9.659373	10.340627	28
33	9.618558	9.958850	9.659708	10.340292	27
34	9.618834	9.958792	9.660042	10.339958	26
35	9.6191[illegible]0	9.958734	9.660376	10.339624	25
36	9.619386	9.958677	9.660710	10.339290	24
37	9.61966[illegible]	9.958619	9.661043	10.338957	23
38	9.619938	9.958561	9.661377	10.338623	22
39	9.620213	9.958503	9.661710	10.338290	21
40	9.620488	9.9[illegible]8445	9.662043	10.337956	20
41	9.620763	9.958387	9.662376	10.337623	19
42	9.621038	9.958329	9.662709	10.337291	18
43	9.621313	9.958271	9.663042	10.336958	17
44	9.621587	9.958212	9.663374	10.336625	16
45	9.621861	9.958154	9.663707	10.336293	15
46	9.622135	9.958096	9.664039	10.335961	14
47	9.622409	9.958038	9.664371	10.335629	13
48	9.622682	9.957979	9.664703	0.335297	12
49	9.622956	9.957921	9.665035	10.334965	11
50	9.623229	9.957862	9.665366	10.334634	10
51	9.623502	9.957804	9.665667	10.334302	9
52	9.623776	9.957745	9.666029	10.333971	8
53	9.624047	9.957687	9.666360	10.333640	7
54	9.624319	9.957628	9.666691	10.333309	6
55	9.624591	9.957570	9.667021	10.332979	5
56	9,624863	9,957511	9,667352	10,332648	4
57	9,625134	9,957452	9,667682	10,332318	3
58	9,625406	9,957393	9,668012	10,331987	2
59	9,625677	9,957334	9,668343	10,331657	1
60	9,625948	9,957276	9,668672	10,331327	0
	Co-ſine	Sine	Co-tang.	Tangent	

Degree 65.

Degree 25.

M	Sine	*Co-ſine*	Tangent	*Co tang.*	
0	9,625948	9,957276	9,668672	10,331327	60
1	9,626219	9,957217	9,669002	10,330998	59
2	9,626490	9,957158	9,669332	10,330668	58
3	9,626760	9,957099	9,669661	10,330339	57
4	9,627030	9,957040	9,669990	10,330009	56
5	9,627300	9,956981	9,670320	10,329680	55
6	9,627570	9,956922	9,670649	10.329351	54
7	9,627840	9,956862	9,670977	10,329022	53
8	9,628109	9,956803	9,671306	10,328694	52
9	9,628378	9,956744	9,671634	10,328365	51
10	9,628697	9,956684	9,671963	10,328037	50
11	9,628916	9,956625	9,672291	10,327709	49
12	9,629184	9,956565	9,672619	10,327381	48
13	9,629453	9,956506	9,672947	10,327053	47
14	9,629721	9,956449	9,673274	10,326725	46
15	9,629989	9,956387	9,673603	10,326398	45
16	9,630257	9,956327	9,673929	10,326070	44
17	6,630524	9,956267	9,674256	10,325743	43
18	9,630792	9,956208	9,674584	10,325416	42
19	9,631059	9,956148	9,674910	10,325089	41
20	9,631326	9,956088	9,675237	10,324763	40
21	9,631592	9,956029	9,675564	10,324436	39
22	9,631856	9,955969	9,675890	10,324110	38
23	9,632125	9,955909	9,676216	10,323783	37
24	9,632392	9,955849	9,676543	10,323457	36
25	9,632657	9,955789	9,676869	10,323131	35
26	9,632923	9,955739	9,677194	10,322805	34
27	9,633189	9,955669	9,677520	10,322480	33
28	9,633454	9,955609	9,677845	10,322154	32
29	9.633719	9,955548	9,678171	10,321829	31
30	9,633984	9,955488	9,678496	10,321504	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 64.

Degree 25.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.633984	9.955488	9.678496	10.321504	30
31	9.634249	9.955428	9.678821	10.321179	29
32	9.634514	9.955367	9.679146	10.320854	28
33	9.634778	9.955307	9.679471	10.320529	27
34	9.635042	9.955246	9.679795	10.320205	26
35	9.635306	9.955186	9.680120	10.319880	25
36	9.635570	9.955125	9.680444	10.319556	24
37	9.635833	9.955065	9.680768	10.319232	23
38	9.636097	9.955004	9.681092	10.318908	22
39	9.636360	9.954944	9.681416	10.318584	21
40	9.636623	9.954883	9.681740	10.318260	20
41	9.636886	9.954823	9.682063	10.317937	19
42	9.637148	9.954762	9.682386	10.317613	18
43	9.637411	9.954701	9.682710	10.317290	17
44	9.637673	9.954640	9.683033	10.316967	16
45	9.637935	9.954579	9.683356	10.316644	15
46	9.638197	9.954518	9.683678	10.316321	14
47	9.638458	9.954457	9.684001	10.315999	13
48	9.638720	9.954396	9.684324	10.315676	12
49	9.638981	9.954335	9.684646	10.315354	11
50	9.639242	9.954274	9.684968	10.315032	10
51	9.639503	9.954213	9.685290	10.314710	9
52	9.639764	9.954152	9.685612	10.314388	8
53	9.640024	9.954090	9.685934	10.314066	7
54	9.640284	9.954029	9.686255	10.313745	6
55	9.640544	9.954968	9.686577	10.313423	5
56	9.640804	9.953906	9.686898	10.31310	4
57	9.641064	9.953845	9.687219	10.31278	3
58	9.641323	9.953783	9.687540	10.312460	2
59	9.641583	9.953722	9.687861	10.312138	1
60	9.641842	9.953660	9.688182	10.311818	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 64.

Degree 26.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9.641842	9.953660	9.688182	10.311818	60
1	9.642101	9.953598	9.688502	10.311498	59
2	9.642360	9.953537	9.688823	10.311177	58
3	9.642618	9.953475	9.689143	10.310857	57
4	9.642876	9.953413	9.689463	10.310537	56
5	9.643135	9.953351	9.689783	10.310217	55
6	9.643393	9.953290	9.690103	10.309897	54
7	9.643650	9.953228	9.690423	10.309577	53
8	9.643908	9.953166	9.690742	10.309258	52
9	9.644165	9.953104	9.691063	10.308938	51
10	9.644423	9.953042	9.691381	10.308619	50
11	9.644680	9.952980	9.691700	10.308300	49
12	9.644936	9.952917	9.692019	10.307981	48
13	9.645193	9.952855	9.692338	10.307662	47
14	9.645449	9.952793	9.692656	10.307343	46
15	9.645706	9.952731	9.692975	10.307025	45
16	9.645962	9.952668	9.693293	10.306706	44
17	9.646218	9.952606	9.693612	10.306388	43
18	9.646473	9.952544	9.693930	10.306070	42
19	9.646729	9.952481	9.694248	10.305752	41
20	9.646984	9.952419	9.694566	10.305434	40
21	9.647239	9.952356	9.694883	10.305117	39
22	9.647494	9.952294	9.695201	10.304799	38
23	9.647749	9.952231	9.695518	10.304482	37
24	9.648004	9.952168	9.695835	10.304164	36
25	9.648258	9.952105	9.696153	10.303847	35
26	9.648510	9.952043	9.696470	10.303530	34
27	9.648766	9.951980	9.696786	10.303213	33
28	9.648020	9.951917	9.697103	10.302897	32
29	9.949274	9.951854	9.697420	10.302580	31
30	9.649527	9.951791	9.697738	10.302264	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 63.

Degree 26.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.649527	9.951791	9.697738	10.302264	30
31	9.649781	9.951728	9.698052	10.301947	29
32	9.650034	9.951665	9.698369	10.301631	28
33	9.650287	9.951602	9.698685	10.301315	27
34	9.650519	9.951539	9.699001	10.300999	26
35	9.650498	9.951476	9.699316	10.300684	25
36	9.651044	9.951412	9.699632	10.300368	24
37	9.651296	9.951349	9.699947	10.300052	23
38	9.651548	9.951286	9.700263	10.299737	22
39	9.651800	9.951222	9.700578	10.299422	21
40	9.652052	9.951159	9.700893	10.299107	20
41	9.652303	9.951095	9.701208	10.298792	19
42	9.65255	9.951032	9.701522	10.298477	18
43	9.652806	9.950968	9.701837	10.298163	17
44	9.653057	9.950905	9.702152	10.297848	16
45	9.653307	9.950841	9.702466	10.297534	15
46	9.653558	9.950777	9.702782	10.297216	14
47	9.653808	9.950714	9.703095	10.296905	13
48	9.654059	9.950650	9.703409	10.296591	12
49	9.654309	9.950589	9.703722	10.296277	11
50	9.654558	9.950522	9.704036	10.295964	10
51	9.654808	9.950458	9.704350	10.295650	9
52	9.655057	9.950394	9.704663	10.295337	8
53	9.655307	9.950330	9.704976	10.295023	7
54	9.655556	9.950266	9.705290	10.294710	6
55	9.655805	9.950202	9.705603	10.294397	5
56	9.656053	9.950138	9.705915	10.294084	4
57	9.656302	9.950074	9.706228	10.293771	3
58	9.656550	9.950009	9.706541	10.293459	2
59	9.656799	9.949945	9.706853	10.293146	1
60	9.656347	9.949881	9.707166	10.292834	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 63.

Degree 27.

M	Sine	Co-ſine	Tangent	Co-tang	
0	9.657047	9.949880	9.707166	10.292834	60
1	9.657295	9.949816	9.707478	10.292523	59
2	9.657542	9.949752	9.707790	10.292210	58
3	9.657790	9.949687	9.708102	10.291897	57
4	9.658037	9.949623	9.708414	10.291586	56
5	9.658284	9.949598	9.708726	10.291274	55
6	9.658538	9.949494	9.709037	10.290962	54
7	9.658777	9.949429	9.709349	10.290651	53
8	9.659024	9.949364	9.709660	10.290340	52
9	9.659271	9.949300	9.709971	10.290029	51
10	9.659517	9.949235	9.710382	10.289718	50
11	9.659763	9.949170	9.710593	10.289407	49
12	9.660009	9.949105	9.710904	10.289096	48
13	9.660255	9.949040	9.711214	10.288785	47
14	9.660500	9.948976	9.711525	10.288475	46
15	9.660746	9.948910	9.711836	10.288164	45
16	9.660991	9.948845	9.712146	10.287854	44
17	9.661236	9.948760	9.712456	10.287544	43
18	9.661481	9.948715	9.712766	10.287234	42
19	9.661726	9.948650	9.713076	10.286924	41
20	9.661970	9.948584	9.713386	10.286614	40
21	9.662214	9.948519	9.713695	10.286305	39
22	9.662459	9.948453	9.714005	10.285995	38
23	9.662702	9.948388	9.714314	10.285686	37
24	9.662947	9.948323	9.714624	10.285376	36
25	9.663190	9.948257	9.714933	10.285067	35
26	9.663433	9.948191	9.715242	10.284658	34
27	9.663677	9.948126	9.715550	10.284449	33
28	9.663920	9.948060	9.715859	10.284140	32
29	9.664163	9.947995	9.716168	10.283832	31
30	9.664406	9.947929	9.716477	10.283523	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 62.

Degree 27.

M	Sine	Co-ſine.	Tangent	Co-tang.	
30	9.664406	9.947929	9.716477	10.283523	30
31	9.664648	9,947863	9.716785	10.283215	29
32	9.664891	9.947797	9.717093	10.282907	28
33	9.665133	9.947731	9.717401	10,282598	27
34	9.665375	9.947665	9.717709	10.282290	26
35	9.665617	9.947599	9.718017	10.281983	25
36	9.665858	9.947533	9.718325	10.281673	24
37	9.666100	9.947467	9.718633	10.281367	23
38	9.666341	9.947401	9.718940	10.281060	22
39	9.666583	9.947335	9.719248	10.280752	21
40	9.666824	9.947269	9.719555	10.280445	20
41	9.667065	9.947203	9.719862	10.280138	19
42	9.667305	9.947136	9.720169	10.279831	18
43	9.667546	9.947070	9.720476	10.279524	17
44	9.667786	9.947004	9.720783	10.279217	16
45	9.668026	9.946937	9.721089	10.278911	15
46	9.668266	9.946871	9.721395	10.278604	14
47	9.668506	9.946804	9.721702	10.278298	13
48	9.668746	9.946738	9.722008	10.277991	12
49	9.668986	9.946671	9.722315	10.277685	11
50	9.669225	9.946604	9.722621	10.277379	10
51	9.669464	9.946537	9.722927	10.277073	9
52	9.669703	9.946471	9.723232	10.276768	8
53	9.669942	9.946404	9.723538	10.276462	7
54	9.670181	9.946337	9.723843	10.276156	6
55	9.670419	9.946270	9.724149	10.275851	5
56	9.670657	9.946203	9.724454	10.275546	4
57	9.670896	9.946136	9.724759	10.275240	3
58	9.671134	9.946069	9.725065	10.274935	2
59	9.671372	9.946002	9.725369	10.274630	1
60	9.671609	9.945935	9.725674	10.274326	0
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 62.

Degree 28.

M	Sine	Co-ſine	Tangent	Co tang.	
0	9,671690	9,945935	9,725674	10,274326	60
1	9,671847	9,945868	9,725979	0,274021	59
2	9,672084	9,945800	9,726284	10,273816	58
3	9,672321	9,945733	9,726588	10,273412	57
4	9,672558	9,945666	9,726892	10,273107	56
5	9,672795	9,945598	9,727197	10,272803	55
6	9,673032	9,945531	9,727501	0,272499	54
7	9,673268	9,945463	9,727805	10,272195	53
8	9,673505	9,945396	9,728109	10,271891	52
9	9,673741	9,945328	9,728412	10,271587	51
10	9,673977	9,945261	9,728716	10,271284	50
11	9,674213	9,945193	9,729020	10,270980	49
12	9,674448	9,945125	9,729323	10,270677	48
13	9,674684	9,945058	9,729626	0,270374	47
14	9,674919	9,944990	9,729929	0,270070	46
15	9,675154	9,944922	9,730232	10,269767	45
16	9,675389	9,944854	9,730535	10,269464	44
17	9,675623	9,944786	9,730838	10,269162	43
18	9,675859	9,944718	9,731141	10,268859	42
19	9,676094	9,944650	9,731443	10,268556	41
20	9,676328	9,944582	9,731746	10,268254	40
21	9,676562	9,944514	9,732048	10,267952	39
22	9,676796	9,944446	9,732351	10,267649	38
23	9,677030	9,944377	9,732653	10,267347	37
24	9,677264	9,944309	9,732955	10,267045	36
25	9,677497	9,944241	9,733257	10,266743	35
26	9,677731	9,944172	9,733558	10,266441	34
27	9,677964	9,944104	9,733860	10,266140	33
28	9,678197	9,944016	9,734162	10,265838	32
29	9,678430	9,943967	9,734463	10,265537	31
30	9,678663	9,943898	9,734764	10,265236	30
	Co-ſine	Sine	Co-tang.	Tangent	

Degree 61.

Degree 28.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9,678663	9,943898	9,734764	10,265236	30
31	9,678895	9,943830	9,735666	10,264934	29
32	9,679128	9,943761	9,735362	10,264633	28
33	9,679360	9,943692	9,735668	10,264332	27
34	9,679592	9,943624	9,735968	10,264031	26
35	9,679824	9,943555	9,736269	10,263731	25
36	9,680056	9,943486	9,736570	10,263430	24
37	9,680288	9,943417	9,736870	10,263130	23
38	9,680519	9,943348	9,737171	10,262829	22
39	9,680750	9,943279	9,737471	10,262529	21
40	9,680982	9,943210	9,737771	10,262229	20
41	9,681213	9,943141	9,738071	10,261929	19
42	9,681443	9,943072	9,738371	10,261629	18
43	9,681674	9,943003	9,738671	10,261329	17
44	9,681904	9,942933	9,738971	10,261029	16
45	9,682135	9,942864	9,739271	10,260729	15
46	9,682365	9,942795	9,739570	10,260430	14
47	9,682595	9,942725	9,739870	10,260130	13
48	9,682825	9,942656	9,740169	10,259831	12
49	9,683055	9,942587	9,740468	10,259532	11
50	9.683284	9,942517	9,740767	10,259233	10
51	9,683514	9,942448	9,741066	10,258934	9
52	9,683743	9,942378	9,741365	10,258635	8
53	9,683972	9,942308	9,741664	10,258336	7
54	9,684201	9,942239	9,741962	10.258038	6
55	9,684430	9,942169	9,742261	10,257739	5
56	9,684658	9,942099	9,742559	10,257441	4
57	9,684887	9,942029	9,742858	10,257142	3
58	9,685115	9,941059	9,743156	10,256844	2
59	9,685343	9,941889	9,743454	10,256546	1
60	9,685571	9,941819	9,743752	10,256248	0
	Co-sine	Sine	Co-tang.	Tangent.	M

Degree 61.

Degree 29.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9,685571	9,941819	9,743752	10,256248	60
1	9,685799	9,941749	9,744050	10,255950	59
2	9,686027	9,941679	9,744348	10,255652	58
3	9,686254	9,941609	9,744645	10,255355	57
4	9,686482	9,941539	9,744943	10,255057	56
5	9,686709	9,941468	9,745240	10,254760	55
6	9,686936	9,941398	9,745538	10,254462	54
7	9,687163	9,941328	9,745835	10,254265	53
8	9,687389	9,941257	9,746132	10,253868	52
9	9,687616	9,941187	9,746429	10,253571	51
10	9,687842	9,941116	9,746726	10,253274	50
11	9,688069	9,941046	9,747023	10,252977	49
12	9,688295	9,940975	9,747319	10,252680	48
13	9,688523	9,940905	9,747616	10,252384	47
14	9,688747	9,940834	9,747912	10,252087	46
15	9,688972	9,940763	9,748209	10,251791	45
16	9,689198	9,940693	9,748505	10,251495	44
17	9,689421	9,940622	9,748801	10,251199	43
18	9,689648	9,940551	9,749097	10,250902	42
19	9,689873	9,940480	9,749393	10,250607	41
20	9,690098	9,940409	9,749689	10,250311	40
21	9,690323	9,940338	9,749985	10,250015	39
22	9,690548	9,940267	9,750281	10,249719	38
23	9,690772	9,940196	9,750576	10,249424	37
24	9,690996	9,940125	9,750872	10,249128	36
25	9,691220	9,940053	9,751167	10,248833	35
26	9,691444	9,939982	9,751462	10,248538	34
27	9,691668	9,939911	9,751757	10,248243	33
28	9,691892	9,939840	9,752052	10,247948	32
29	9,692115	9,939768	9,752347	10,247653	31
30	9,692339	9,939697	9,752642	10,247358	30
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 60.

Degree 29.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.692339	9.939697	9.752642	10.247358	30
31	9.692562	9.939625	9.752937	10.247063	29
32	9.692785	9.939554	9.753231	10.246769	28
33	9.693008	9.939482	9.753526	10.246474	27
34	9.693231	9.939410	9.753820	10.246180	26
35	9.693453	9.939339	9.754115	10.245885	25
36	9.693676	9.939267	9.754409	10.245591	24
37	9.693898	9.939195	9.754703	10.245297	23
38	9.694120	9.939123	9.754997	10.245003	22
39	9.694342	9.939051	9.755291	10.244709	21
40	9.694664	9.938980	9.755584	10.244415	20
41	9.694786	9.938908	9.755878	10.244122	19
42	9.695007	9.938835	9.756172	10.243828	18
43	9.695229	9.938763	9.756465	10.243535	17
44	9.695450	9.938691	9.756759	10.243241	16
45	9.695671	9.938619	9.757052	10.242948	15
46	9.695892	9.938547	9.757345	10.242655	14
47	9.696113	9.938475	9.757648	10.242362	13
48	9.696334	9.938402	9.757931	10.242069	12
49	9.696554	9.938330	9.758224	10.241776	11
50	9.696774	9.938257	9.758517	10.241483	10
51	9.696995	9.938185	9.758810	10.241190	9
52	9.697215	9.938112	9.759102	10.240898	8
53	9.697435	9.938040	9.759395	10.240605	7
54	9.697654	9.937967	9.759687	10.240313	6
55	9.697874	9.937895	9.759979	10.240021	5
56	9.698093	9.937822	9.760271	10.239728	4
57	9.698313	9.937749	9.760564	10.239436	3
58	9.698532	9.937676	9.760856	10.239144	2
59	9.698751	9.937603	9.761147	10.238852	1
60	9.698970	9.937531	9.761439	10.238561	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 60.

Degree 30.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9.698970	9.937531	9.761439	10.238561	60
1	9.699189	9.937458	9.761731	10.238269	59
2	9.699407	9.937385	9.762023	10.237977	58
3	9.699626	9.937312	9.762314	10.237686	57
4	9 699844	9.937238	9.762606	10.237394	56
5	9.700062	9.937165	9.762897	10.237103	55
6	9.700280	9.937092	9.763188	10.236812	54
7	9.700498	9.937019	9.763479	10.236521	53
8	9.700716	9.936945	9.763770	10.236230	52
9	9.700933	9.936872	9.764061	10.235939	51
10	9.701151	9.936799	9.764352	10.235648	50
11	9.701567	9.936725	9.764643	10.235357	49
12	9.701585	9.936652	9.764933	10.235067	48
13	9.701802	9.936578	9.765224	10.234776	47
14	9.702019	9.936505	9.765514	10.234486	46
15	9.702236	9.936431	9.765805	10.234195	45
16	9.702452	9.936357	9.766095	10.233905	44
17	9.702669	9.936284	9.766385	10.233615	43
18	9.703885	9.936210	9.766675	10.233325	42
19	9.703101	9.936136	9.766965	10.233035	41
20	9.703317	9.936062	9.767255	10.232745	40
21	9.703533	9.935988	9.767545	10.232455	39
22	9.703748	9.935914	9.767834	10.232166	38
23	9.703964	9.935840	9.768124	10.231876	37
24	9.704179	9.935766	9.768413	10.231587	36
25	9.704395	9.935692	9.768703	10.231297	35
26	9.704610	9.935618	9.768992	10.231008	34
27	9.704825	9.935543	9.769281	10.230719	33
28	9.705040	9.935469	9.769570	10.230430	32
29	9.705254	9.935395	9.769859	10.230141	31
30	9.705469	9.935320	9.770148	10.229852	30
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 59.

Degree 30.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.705469	9.935320	9.770148	10.229852	30
31	9.705683	9.935246	9.770437	10.229563	29
32	9.705897	9.935171	9.770726	10.229274	28
33	9.706112	9.935097	9.771015	10.228985	27
34	9 706326	9.935022	9.771303	10.228697	26
35	9.706539	9.934948	9.771592	10.228408	25
36	9.706753	9.934873	9.771880	10.228120	24
37	9.706967	9.934798	9.772168	10.227832	23
38	9.707180	9.934723	9.772456	10.227543	22
39	9.707393	9.934649	9.772745	10.227255	21
40	9.707606	9.934574	9.773033	10.226967	20
41	9.707819	9.934499	9.773321	10.226679	19
42	9.708032	9.934424	9.773608	10.226391	18
43	9.708245	9.934349	9.773896	10.226104	17
44	9.708457	9.934274	9.774184	10.225816	16
45	9.708670	9.934199	9.774471	10.225529	15
46	9.708882	9.934123	9.774759	10.225241	14
47	9.709094	9.934048	9.775046	10.224954	13
48	9.709306	9.933973	9.775333	10.224666	12
49	9.709518	9.933897	9.775621	10.224379	11
50	9.709730	9.933322	9.775908	10.224092	10
51	9.709941	9.933747	9.775195	10.223805	9
52	9.710153	9.933671	9.776482	10.223518	8
53	9.710364	9.933596	9.776768	10.223232	7
54	9.710575	9.933520	9.777055	10.222945	6
55	9.710786	9.933444	9.777342	10.222658	5
56	9.710997	9.933369	9.777628	10.222372	4
57	9.711208	9.933293	9.777915	10.222085	3
58	9.711418	9.933217	9.778201	10.221799	2
59	9.711629	9.933141	9.778487	10.221513	1
60	9.711839	9.933066	9.778774	10.221226	0
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 59.

Degree 31.

M	Sine	Co-ſine	Tangent	Co-tang	
0	9.711839	9.933066	9.778774	10.221226	60
1	9.712049	9.932990	9.779060	10.220940	59
2	9.712259	9.932914	9.779346	10.220654	58
3	9.712469	9.932838	9.779632	10.220368	57
4	9.712679	9.932761	9.779918	10.220082	56
5	9.712889	9.932685	9.780203	10.219796	55
6	9.713098	9.932609	9.780489	10.219511	54
7	9.713308	9.932533	9.780775	10.219225	53
8	9.713517	9.932457	9.781060	10.218940	52
9	9.713726	9.932380	9.781346	10.218654	51
10	9.713935	9.932304	9.781631	10.218369	50
11	9.714144	9.932227	9.781916	10.218084	49
12	9.714352	9.932151	9.782202	10.217799	48
13	9.714561	9.932074	9.782486	10.217514	47
14	9.714769	9.931998	9.782771	10.217229	46
15	9.714977	9.931921	9.783056	10.216944	45
16	9.715186	9.931845	9.783341	10.216659	44
17	9.715394	9.931768	9.783626	10.216374	43
18	9.715601	9.931691	9.783910	10.216090	42
19	9.715809	9.931614	9.784195	10.215805	41
20	9.716017	9.931537	9.784479	10.215520	40
1	9.716224	9.931460	9.784764	10.215236	39
2	9.716431	9.931383	9.785048	10.214952	38
3	9.716639	9.931306	9.785332	10.214668	37
4	9.716846	9.931229	9.785616	10.214384	36
5	9.717053	9.931152	9.785900	10.214099	35
26	9.717259	9.931075	9.786184	10.213816	34
27	9.717456	9.930998	9.786468	10.213532	33
28	9.717672	9.930920	9.786752	10.213248	32
29	9.717869	9.930843	9.787036	10.212964	31
30	9.718085	9.930766	9.787319	10.212681	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 58.

Degree 31.

M	Sine	Co-ſine.	Tangent	Co-tang.	
30	9.718085	9.930766	9.787319	10.212681	30
31	9.71829	9.930688	9.787603	10.212397	29
32	9.718497	9.930611	9.787886	10.212114	28
33	9.718703	9.930533	9.788170	10.211830	27
34	9.718929	9.930456	9.788452	10.211547	26
35	9.719114	9.930378	9.788736	10.211264	25
36	9.719320	9.930300	9.789019	10.210981	24
37	9.719525	9.930223	9.789302	10.210698	23
38	9.719730	9.93014	9.789585	10.210415	22
39	9.719935	9.930067	9.789868	10.210132	21
40	9.720140	9.929989	9.790151	10.209849	20
41	9.720345	9.929911	9.790433	10.209565	19
42	9.720549	9.929833	9.790716	10.209284	18
43	9.720754	9.929755	9.790999	10.209001	17
44	9.720958	9.929677	9.790281	10.208719	16
45	9.721162	9.929599	9.791563	10.208436	15
46	9.721366	9.929521	9.791846	10.208154	14
47	9.721570	9.929442	9.792128	10.207872	13
48	9.721774	9.929364	9.792410	10.207590	12
49	9.721978	9.929286	9.792692	10.207308	11
50	9.722181	9.929207	9.792974	10.207024	10
51	9.722385	9.929129	9.793256	10.206744	9
52	9.722588	9.929050	9.793538	10.206462	8
53	9.722791	9.928972	9.793819	10.206180	7
54	9.722994	9.928893	9.794101	10.205899	6
55	9.723197	9.928814	9.794383	10.205617	5
56	9.723400	9.928736	9.794664	10.205336	4
57	9.723603	9.928657	9.794945	10.205054	3
58	9.723805	9.928578	9.795227	10.204773	2
59	9.724007	9.928499	9.795508	10.204492	1
60	9.724210	9.928420	9.795789	10.204211	0
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 58.

Degree 31.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9,724210	9,928420	9,795789	10,204211	60
1	9,724412	9,928341	9,796070	10,203930	59
2	9,724614	9,928262	9,796351	10,203649	58
3	9,724816	9,928183	9,796632	10,203368	57
4	9,725017	9,928104	9,796913	10,203087	56
5	9,725219	9,928025	9,797194	10,202806	55
6	9,725420	9,927946	9,797474	10,202522	54
7	9,725622	9,927867	9,797755	10,202245	53
8	9,725823	9,927787	9,798036	10,201964	52
9	9,726024	9,927708	9,798316	10,201684	51
10	9,726225	9,927628	9,798596	10,201404	50
11	9,726426	9,927549	9,798877	10,201123	49
12	9,726626	9,927469	9,799157	10,200843	48
13	9,726827	9,927390	9,799437	10,200563	47
14	9,727027	9,927310	9,799717	10,200283	46
15	9,727228	9,927231	9,799997	10,200003	45
16	9,727428	9,927428	9,800277	10,199723	44
17	9,727628	9,927628	9,800557	10,199443	43
18	9,727828	9,926828	9,800836	10,199163	42
19	9,728027	9,926027	9,801116	10,198884	41
20	9,728227	9,926227	9,801396	10,198604	40
21	9,728437	9,926751	9,801675	10,198325	39
22	9,728626	9,926671	9,801955	10,198045	38
23	9,728825	9,926591	9,802234	10,197766	37
24	9,729024	9,926511	9,802513	10,197487	36
25	9,729223	9,926431	9,802792	10,197207	35
26	9,729422	9,926351	9,803072	10,196928	34
27	9,729621	9,926270	9,803351	10,196649	33
28	9,729820	9,926190	9,803630	10,196370	32
29	9,730018	9,926110	9,803908	10,196091	31
30	9,730216	9,926029	9,804187	10,195813	30
	Co-ſine	Sine	*Co-tang.*	Tangent.	M

Degree 57.

Degree 32.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9,730216	9,926029	9,804187	10,195813	30
31	9,730415	9,925949	9,804466	10,195534	29
32	9,730613	9,925868	9,804745	10,195255	28
33	9,730811	9,925787	9,805023	10,194977	27
34	9,731009	9,925707	9,805302	10,194698	26
35	9,731206	9,925626	9,805580	10,194420	25
36	9,731404	9,925545	9,805859	10,194141	24
37	9,731601	9,925464	9,806137	10,193863	23
38	9,731799	9,925384	9,806415	10,193585	22
39	9,731996	9,925303	9,806693	10,193309	21
40	9,732193	9,925222	9,806971	10,193028	20
41	9,732390	9,925141	9,807249	10,192751	19
42	9,732587	9,925060	9,807527	10,192433	18
43	9,732784	9,924978	9,807805	10,192195	17
44	9,732980	9,924897	9,808083	10,191917	16
45	9,733177	9,924816	9,808361	10,191639	15
46	9,733373	9,924735	9,808638	10,191362	14
47	9,733569	9,924653	9,808916	10,191084	13
48	9,733765	9,924572	9,809193	10,190807	12
49	9,733961	9,924491	9,809471	10,190529	11
50	9,734197	9,924409	9,809748	10,190252	10
51	9,734353	9,924328	9,810025	10,189975	9
52	9,734548	9,924246	9,810302	10,189697	8
53	9,734744	9,924164	9,810580	10,189420	7
54	9,734939	9,924083	9,810857	10,189143	6
55	9,735134	9,924001	9,811134	10,188866	5
56	9,735330	9,923919	9,811410	10,188589	4
57	9,735525	9,923837	9,811687	10,188313	3
58	9,735719	9,923755	9,811964	10,188036	2
59	9,735914	9,923673	9,812241	10,187759	1
60	9,736109	9,923591	9,812517	10,187483	0
	Co-ſine	Sine	*Co-tang*	Tangent	M

Degree 57.

Degree 33.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9,736109	9,923591	9,812517	10,187483	60
1	9,736309	9,923509	9,812794	10,187206	59
2	9,786497	9,923427	9,813070	10,186930	58
3	9,736692	9,923345	9,813347	10,186653	57
4	9,736886	9,923263	9,813623	10,186377	56
5	9,737080	9,923180	9,813899	10,186101	55
6	9,737274	9,923098	9,814175	10,185824	54
7	9,737467	9,923016	9,814452	10,185548	53
8	9,737661	9,922933	9,814728	10,185272	52
9	9,737854	9,922851	9,815004	10,184996	51
10	9,738048	9,922768	9,815279	10,184720	50
11	9,738241	9,922686	9,815555	10,184445	49
12	9,738434	9,922603	9,815831	10,184169	48
13	9,738627	9,922520	9,816107	10,183893	47
14	9,738820	9,922438	9,816382	10,183617	46
15	9,739013	9,922355	9,816658	10,183342	45
16	9,739205	9,922272	9,816933	10,183066	44
17	9,739398	9,922189	9,817209	10,182791	43
18	9,739590	9,922106	9,817484	10,182516	42
19	9,739783	9,922023	9,817759	10,182240	41
20	9,739975	9,921940	9,818035	10,181965	40
21	9,740167	9,921857	9,818310	10,181690	39
22	9,740359	9,921774	9,818585	10,181415	38
23	9,740550	9,921691	9,818860	10,181140	37
24	9,740742	9,921607	9,819135	10,180865	36
25	9,740934	9,921524	9,819410	10,180590	35
26	9,741125	9,921441	9,819684	10,180315	34
27	9,741316	9,921357	9,819959	10,180041	33
28	9,741507	9,921274	9,820234	10,179766	32
29	9,741698	9,921190	9,820508	10,179492	31
30	9,741889	9,921107	9,820783	10,179217	30
	Co-ſine	Sine	*Co-tang.*	Tangent	

Degree 56.

Degree 33.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.741889	9.921107	9.820783	10.179217	30
31	9.742080	9.921023	9.821057	10.178943	29
32	9.742271	9.920939	9.821332	10.178668	28
33	9.742461	9.920855	9.821606	10.178394	27
34	9.742652	9.920772	9.821880	10.178120	26
35	9.742842	9.920688	9.822154	10.177846	25
36	9.743032	9.920604	9.822429	10.177571	24
37	9.743223	9.920520	9.822703	10.177297	23
38	9.743412	9.920436	9.822977	10.177023	22
39	9.743602	9.920352	9.823250	10.176739	21
40	9.743792	9.920268	9.823524	10.176476	20
41	9.743982	9.920184	9.823798	10.176202	19
42	9.744171	9.920099	9.824072	10.175928	18
43	9.744361	9.920015	9.824345	10.175655	17
44	9.744550	9.919931	9.824619	10.175381	16
45	9.744739	9.919846	9.824892	10.175108	15
46	9.744928	9.919762	9.825166	10.174834	14
47	9.745117	9.919677	9.825439	10.174560	13
48	9.745306	9.919593	9.825713	10.174287	12
49	9.745494	9.919508	9.825986	10.174014	11
50	9.745683	9.919424	9.826259	10.173741	10
51	9.745871	9.919339	9.826532	10.173468	9
52	9.746059	9.919254	9.826805	10.173195	8
53	9.746248	9.919169	9.827078	10.172922	7
54	9.746436	9.919084	9.827351	10.172649	6
55	9.746624	9.918999	9.827624	10.172376	5
56	9.746811	9.918915	9.827897	10.172103	4
57	9.746999	9.918830	9.828170	10.171830	3
58	9.747187	9.918744	9.828442	10.171558	2
59	9.747374	9.918659	9.828715	10.171285	1
60	9.747562	9.918574	9.828987	10.171012	0
	Co-ſine	Sine	Co-tang.	Tangent.	

Degree 56.

Degree 34.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9.747562	9.918574	9.828987	10.171012	60
1	9.747749	9.918489	9.829260	10.170740	59
2	9.747936	9.918404	9.829532	10.170468	58
3	9.748123	9.918318	9.829805	10.170195	57
4	9.748310	9.918233	9.830077	10.169923	56
5	9.748497	9.918147	9.830349	10.169651	55
6	9.748683	9.918062	9.830621	10.169379	54
7	9.748870	9.917976	9.830893	10.169106	53
8	9.749056	9.917891	9.831165	10.168834	52
9	9.749242	9.917805	9.831437	10.168563	51
10	9.749429	9.917719	9.831709	10.168291	50
11	9.749615	9.917634	9.831981	10.168019	49
12	9.749801	9.917548	9.832253	10.167747	48
13	9.749986	9.917462	9.832525	10.167475	47
14	9.750172	9.917376	9.832796	10.167204	46
15	9.750358	9.917290	9.833068	10.166932	45
16	9.750543	9.917204	9.833339	10.166660	44
17	9.750729	9.917118	9.833611	10.166389	43
18	9.750914	9.917032	9.833882	10.166118	42
19	9.751099	9.916945	9.834154	10.165846	41
20	9.751284	9.916859	9.834425	10.165575	40
21	9.751469	9.916773	9.834696	10.165304	39
22	9.751654	9.916686	9.834967	10.165033	38
23	9.751838	9.916600	9.835238	10.164762	37
24	9.752023	9.916514	9.835509	10.164491	36
25	9.752207	9.916427	9.835780	10.164220	35
26	9.752392	9.916340	9.836051	10.163949	34
27	9.752576	9.916254	9.836322	10.163678	33
28	9.752760	9.916167	9.836593	10.163407	32
29	9.752944	9.916080	9.836864	10.163136	31
30	9.753128	9.915994	9.837134	10.162866	30
	Co-ſine	Sine	*Co-tang*	Tangent	M

Degree 55.

Degree 34.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.753128	9.915994	9.837134	10.162866	30
31	9.753312	9.915907	9.837405	10.162595	29
32	9.753495	9.915820	9.837675	10.162325	28
33	9.753679	9.915733	9.837946	10.162054	27
34	9.753862	9.915646	9.838216	10.161784	26
35	9.754046	9.915559	9.838487	10.161513	25
36	9.754229	9.915472	9.838757	10.161243	24
37	9.754412	9.915385	9.839027	10.160973	23
38	9.754595	9.915297	9.839297	10.160702	22
39	9.754778	9.915210	9.839568	10.160432	21
40	9.754960	9.915123	9.839838	10.160162	20
41	9.755143	9.915035	9.840108	10.159892	19
42	9.755325	9.914948	9.840378	10.159622	18
43	9.755508	9.914860	9.840647	10.159352	17
44	9.755690	9.914773	9.840917	10.159083	16
45	9.755872	9.914685	9.841187	10.158813	15
46	9.756054	9.914597	9.841457	10.158543	14
47	6.756236	9.914510	9.841726	10.158273	13
48	9.756418	9.914422	9.841996	10.158004	12
49	9.756600	9.914334	9.842266	10.157734	11
50	9.756781	9.914246	9.842535	10.157465	10
51	9.756963	9.914158	9.842804	10.157195	9
52	9.757144	9.914070	9.843074	10.156926	8
53	9.757326	9.913982	9.843343	10.156657	7
54	9.757507	9.913894	9.843612	10.156387	6
55	9.757688	9.913806	9.843882	10.156118	5
56	9.757869	9.913718	9.844151	10.155849	4
57	9.758049	9.913630	9.844420	10.155580	3
58	9.758230	9.913541	9.844689	10.155311	2
59	9.758411	9.913453	9.844958	10.155042	1
60	9.758591	9.913364	9.845227	10.154774	0
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 55.

Degree 35.

M	Sine	Co-ſine	Tangent	Co-tang	
0	9.758591	9.913364	9.845227	10.154774	60
1	9.758772	9.913276	9.845496	10.154504	59
2	9.758952	9.913187	6.845764	10.154235	58
3	9.759132	9.913099	9.846033	10.153967	57
4	9.759312	9.913010	9.846302	10.153698	56
5	9.759492	9.912921	9.846570	10.153429	55
6	9.759672	9.912833	9.846839	10.153161	54
7	9.759851	9.912744	9.847107	10.152893	53
8	9.760031	9.912655	9.847376	10.152624	52
9	9.760210	9.912566	9.847644	10.152356	51
10	9.760390	9.912477	9.847913	10.152087	50
11	9.760569	9.912388	9.848181	10.151819	49
12	9.760748	9.912299	9.848449	10.151551	48
13	9.760927	9.912210	9.848717	10.151283	47
14	9.761106	9.912121	9.848985	10.151015	46
15	9.751285	9.912030	9.849254	10 150746	45
16	9.761464	9.911942	9.849522	10.150478	44
17	9.761642	9.911853	9.849789	10.150214	43
18	9.761821	9.911763	9.850057	10.149943	42
19	9.761999	9.911674	9.850325	10.149675	41
20	9.762177	9.911584	9.850593	10.149467	40
21	9.762356	9.911495	9.850861	10.149139	39
22	9.762534	9.911405	9.851128	10.148872	38
23	9.762712	9.911315	9.851396	10.148604	37
24	9.762889	9.911226	9.851664	10.148336	36
25	9.763067	9.911136	9.851931	10.148069	35
26	9.763245	9.911046	9.852199	10.147801	34
27	9.763422	9.920956	9.852466	10.147534	33
28	9.763599	9.910866	9.852731	10.147267	32
29	9.763777	9.910776	9.853001	10.146999	31
30	9.763954	9.910686	9.853268	10.146732	30
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 54.

Degree 35.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.763954	9.910686	9.853268	10.1466732	30
31	9.764131	9.910596	9.853532	10.146465	29
32	9.764308	9.910506	9.853802	10.146198	28
33	9.764485	9.910415	9.854069	10.145970	27
34	9.764662	9.910325	9.854336	10.145664	26
35	9.764838	9.910235	9.854603	10.145397	25
36	9.765015	9.910144	9.854870	10.145130	24
37	9.765191	9.910054	9.855137	10.144863	23
38	9.765367	9.909963	9.855404	10.144596	22
39	9.765544	9.909873	9.855671	10.144329	21
40	9.765720	9.909782	9.855937	10.144063	20
41	9.765896	9.909691	9.856204	10.143796	19
42	9.766071	9.909601	9.856471	10.143529	18
43	9.766247	9.909510	9.856737	10.143268	17
44	9.766423	9.909419	9.857004	10.142996	16
45	9.766598	9.909328	9.857270	10.142730	15
46	9.766774	9.909237	9.857537	10.142463	14
47	9.766949	9.909146	9.857803	10.142197	13
48	9.767124	9.909055	9.858069	10.141931	12
49	9.767299	9.908964	9.858336	10.141664	11
50	9.767474	9.908873	9.858602	10.141398	10
51	9.767649	9.908781	9.858868	10.141132	9
52	9.767824	9.908690	9.859134	10.140866	8
53	9.767997	9.908599	9.859400	10.140600	7
54	9.768173	9.908507	9.859666	10.140334	6
55	9.768348	9.908416	9.859932	10.140068	5
56	9.768522	9.908324	9.860198	10.139802	4
57	9.768696	9.908233	9.860464	10.139536	3
58	9.768871	9.908141	9.860730	10.139270	2
59	9.769045	9.908049	9.860995	10.139005	1
60	9.769219	9.907958	9.861261	10.138739	0
	Co-ſine	Sine	Co-tang.	Tangent.	

Degree 54.

Degree 36.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9,769229	9,907958	9,861261	10,138739	60
1	9,769392	9,907866	9,861527	10,138473	59
2	9,769566	9,907774	9,861792	10,138208	58
3	9,769740	9,907682	9,862058	10,137942	57
4	9,769913	9,907590	9,862323	10,137677	56
5	9,770087	9,907498	9,862589	10,137411	55
6	9,770260	9,907406	9,862854	10,137146	54
7	9,770433	9,907314	9,863119	10,136880	53
8	9,770606	9,907221	9,863385	10,136615	52
9	9,770779	9,907129	9,863650	10,136350	51
10	9,770952	9,907037	9,863915	10,136085	50
11	9,771125	9,906945	9,864180	10,135820	49
12	9,771298	9,906852	9,864445	10,135554	48
13	9,771470	9,906760	9,864710	10,135289	47
14	9,771643	9,906667	9,864975	10,135024	46
15	9,771815	9,906574	9,865240	10,134759	45
16	9,771987	9,906482	9,865505	10,134495	44
17	9,772159	9,906389	9,865770	10,134230	43
18	9,772331	9,906296	9,866035	10,133965	42
19	9,772503	9,906203	9,866300	10,133700	41
20	9,772675	9,906111	9,866564	10,133436	40
21	9,772847	9,906018	9,866829	10,133171	39
22	9,773018	9,905925	9,867094	10,132906	38
23	9,773190	9,905832	9,867358	10,132642	37
24	9,773361	9,905738	9,867623	10,132377	36
25	9,773533	9,905645	9,867887	10,132113	35
26	9,773704	9,905552	9,868152	10,131848	34
27	9,773875	9,905459	9,868416	10,131584	33
28	9,774046	9,905365	9,868680	10,131320	32
29	9,774217	9,905272	9,868945	10,131055	31
30	9,774388	9,905179	9,869209	10,130791	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 53.

Degree 36.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9,774388	9,905179	9,869209	10,130791	30
31	9,774558	9,905085	9,869773	10,130527	29
32	9,774729	9,904992	9,869337	10,130263	28
33	9,774899	9,904898	9,870001	10,129999	27
34	9,775070	9,904804	9,870265	10,129735	26
35	9,775240	9,904711	9,870529	10,129471	25
36	9,775410	9,904617	9,870793	10,129207	24
37	9,775580	9,904523	9,871057	10,128943	23
38	9,775750	9,904429	9,871321	10,128679	22
39	9,775920	9,904335	9,871585	10,128415	21
40	9,776090	9,904241	9,871849	10,128151	20
41	9,776259	9,904147	9,872112	10,127888	19
42	9,776429	9,904053	9,872376	10,127624	18
43	9,776598	9,903959	9,872640	10,127360	17
44	9,776768	9,903864	9,872903	10,127097	16
45	9,776937	9,903770	9,873167	10,126833	15
46	9,777106	9,903676	9,873430	10,126570	14
47	9,777275	9,903581	9,873694	10,126306	13
48	9,777444	9,903486	9,873957	10,126043	12
49	9,777613	9,903392	9,874220	10,125780	11
50	9,777781	9,903298	9,874484	10,125516	10
51	9,777950	9,903203	9,874747	10,125253	9
52	9,778119	9,903108	9,875010	10,124990	8
53	9,778287	9,903013	9,875273	10,124727	7
54	9,778455	9,902919	9,875536	10,124464	6
55	9,778623	9,902824	9,875799	10,124201	5
56	9,778792	9,902729	9,876063	10,123937	4
57	9,778960	9,902634	9,876326	10,123674	3
58	9,779129	9,902539	9,876589	10,123411	2
59	9,779295	9,902444	9,876851	10,123149	1
60	9,779463	9,902349	9,877114	10,122885	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 53.

Degree 37.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
0	9,779463	9,902349	9,877114	10,122885	60
1	9,779631	9,902253	9,877377	10,122623	59
2	9,779798	9,902158	9,877640	10,122360	58
3	9,779965	9,902063	9,877903	10,122097	57
4	9,780133	9,901967	9,878165	10,121834	56
5	9,780300	9,901872	9,878428	10,121572	55
6	9,780467	9,901776	9,878691	10,121309	54
7	9,780634	9,901681	9,878953	10,121047	53
8	9,780801	9,901585	9,879216	10,120784	52
9	9,780968	9,901488	9,879478	10,120522	51
10	9,781134	9,901391	9,879741	10,120259	50
11	9,781301	9,901298	9,880003	10,119997	49
12	9,781467	9,901202	9,880265	10,119734	48
13	9,781634	9,901106	9,880528	10,119472	47
14	9,781800	9,901010	9,880790	10,119210	46
15	9,781966	9,900914	9,881052	10,118948	45
16	9,782132	9,900828	9,881314	10,118686	44
17	9,782298	9,900722	9,881576	10,118424	43
18	9,782464	9,900626	9,881839	10,118161	42
19	9,782690	9,900529	9,882101	10,117899	41
20	9,782796	9,900433	9,882363	10,117637	40
21	9,782961	9,900337	9,882625	10,117375	39
22	9,783127	9,900240	9,882886	10,117114	38
23	9,783292	9,900144	9,883148	10,116852	37
24	9,783457	9,900047	9,883410	10,116590	36
25	9,783623	9,899951	9,883672	10,116328	35
26	9,783788	9,899854	9,883934	10,116066	34
27	9,783953	9,899757	9,884195	10,115805	33
28	9,784118	9,899660	9,884457	10,115543	32
29	9,784282	9,899563	9,884719	10,115281	31
30	9,784447	9,899467	9,884980	10,115020	30
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 52.

Degree 37.

M	Sine	Co-sine		Tangent	Co-tang.	
30	9.784447	9.899267		9.884980	10.115020	30
31	9.784616	9.899370		9.885242	10.114758	29
32	9.784776	9.899273		9.885503	10.114497	28
33	9.784941	9.899175		9.885765	10.114235	27
34	9.785105	9.899078		9.886029	10.113974	26
35	9.785269	9.898981		9.886288	10.113712	25
36	9.785433	9.898884		9.886549	10.113451	24
37	9.785591	9.898784		9.886810	10.113190	23
38	9.785761	9.898689		9.887072	10.112928	22
39	9.785925	9.898592		9.887333	10.112667	21
40	9.786088	9.898494		9.887594	10.112406	20
41	9.786252	9.898397		9.887855	10.112145	19
42	9.786416	9.898299		9.888116	10.111884	18
43	9.786579	9.898201		9.888377	10.111623	17
44	9.786742	9.898104		9.888638	10.111362	16
45	9.786909	9.898006		9.888899	10.111101	15
46	9.787019	9.897908		9.889160	10.110840	14
47	9.787232	9.897810		9.889421	10.110579	13
48	9.787395	9.897112		9.889682	10.110318	12
49	9.787557	9.897614		9.889943	10.110057	11
50	9.787720	9.897519		9.880204	10.109796	10
51	9.787883	9.897418		9.890965	10.109535	9
52	9.788045	9.897320		9.890725	10.109275	8
53	9.788208	9.897222		9.890986	10.109014	7
54	9.788370	9.897123		9.891247	10.108753	6
55	9.788532	9.897025		9.891507	10.108493	5
56	9.788694	9.896926		9.891768	10.108232	4
57	9.788856	9.896828		9.892028	10.107972	3
58	9.789018	9.896729		9.892289	10.107711	
59	9.789180	9.896631		9.892549	10.107451	1
60	9.789342	9.896532		9.892810	10.107190	
	Co-sine	Sine		Co-tang.	Tangent	M

Degree 52.

Degree 38.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9.789342	9.896532	9.892810	10.107190	60
1	9.789504	9.896433	9.893070	10.106930	59
2	9.789665	9.896335	9.893330	10.106669	58
3	9.789827	9.896236	9.893591	10.106409	57
4	9.789988	9.896137	9.893851	10.106149	56
5	9.790149	9.896038	9.894111	10.105889	55
6	9.790310	9.895939	9.894371	10.105628	54
7	9.790471	9.895840	9.894632	10.105368	53
8	9.790632	9.895741	9.894892	10.105108	52
9	9.790793	9.895641	9.895152	10.104848	51
10	9.790954	9.895542	9.895412	10.104588	50
11	9.791115	9.895443	9.895672	10.104328	49
12	9.791275	9.895343	9.895932	10.104068	48
13	9.791436	9.895244	9.896192	10.103808	47
14	9.791596	9.895144	9.896452	10.103548	46
15	9.791756	9.895045	9.896712	10.103288	45
16	9.791917	9.894945	9.896971	10.103028	44
17	9.792077	9.894846	9.897231	10.102769	43
18	9.792237	9.894746	9.897491	10.102509	42
19	9.792397	9.894646	9.897751	10.102249	41
20	9.792557	9.894546	9.898010	10.101990	40
21	9.792716	9.894446	9.898270	10.101730	39
22	9.792876	9.894346	9.898530	10.101470	38
23	9.793035	9.894245	9.898789	10.101211	37
24	9.793195	9.894146	9.899049	10.100951	36
25	9.793354	9.894046	9.899308	10.100692	35
26	9.793513	9.893946	9.899568	10.100432	34
27	9.793673	9.893845	9.899827	10.100173	33
28	9.793832	9.893745	9.900086	10.099913	32
29	9.793991	9.893645	9 900346	10.099654	31
30	9.794149	9.893444	9.900605	10.099395	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 51.

Degree 38.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.794149	9,893444	9.900605	10.099395	30
31	9.794308	9.893444	9.900864	10.099135	29
32	9.794467	9.893343	9.901124	10.098876	28
33	9.794626	9.893243	9.901383	10.098617	27
34	9.794784	9.893142	9.901642	10.098358	26
35	9.794942	9.893041	9.901991	10.098099	25
36	9.795101	9.892940	9.902160	10.097839	24
37	9.795259	9.892839	9.902419	10.097580	23
38	9.795417	9.892738	9.902678	10.097321	22
39	9.795575	9.892637	9.902937	10.097062	21
40	9.795733	9.892536	9.903196	10.096803	20
41	9.795891	9.892435	9.903455	10.096544	19
42	9.796049	9.892334	9.903714	10.096285	18
43	9.796206	9.892233	9.903973	10.096027	17
44	9.796364	9.892132	9.904232	10.095768	16
45	9.796521	9.892030	9.904491	10.095509	15
46	9.796678	9.891928	9.904750	10.095250	14
47	9.796836	9.891827	9.905008	10.094991	13
48	9.796993	9.891726	9.905267	10.094733	12
49	9.797150	9.891624	9.905526	10.094474	11
50	9.797307	9.891522	9.905784	10.094215	10
51	9.797467	9.891421	9.906043	10.093957	9
52	9.797621	9.891319	9.906302	10.093698	8
53	9.797777	9.891217	9.906510	10.093440	7
54	9.797934	9.891115	9.906819	10.093181	6
55	9.798091	9.891013	9.907077	10.092923	5
56	9.798247	9.890911	9.907336	10.092664	4
57	9.798403	9.890809	9.907594	10.092406	3
58	9.798560	9.890707	9.907852	10.092147	2
59	9.798716	9.890605	9.908111	10.091889	1
60	9.798872	9.890503	9.908369	10.091631	0
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 51.

Degree 39.

M	Sine	*Co-ſine*	Tangent	*Co-tang*	
0	9.798872	9.890503	9.908369	10.091631	60
1	9.799028	9.890400	9.908627	10.091373	59
2	9.799184	9.890298	9.908886	10.091114	58
3	9.799336	9.890195	9.909144	10.090856	57
4	9.799495	9.890093	9.909402	10.090598	56
5	9.799651	9.889990	9.909560	10.090840	55
6	9.799806	9.889888	9.909918	10.090081	54
7	9.799961	9.889785	9.910176	10.089823	53
8	9.800117	9.889682	9.910435	10.089565	52
9	9.800272	9.889579	9.910693	10.089307	51
10	9.800427	9.889476	9.910951	10.089049	50
11	9.800582	9.889374	9.911209	10.088791	49
12	9.800737	9.889271	9.911467	10.088533	48
13	9.800892	9.889167	9.911724	10.088275	47
14	9.801047	9.889064	9.911982	10.088017	46
15	9.801201	9.888961	9.912240	10.087760	45
16	9.801356	9.888858	9.912498	10.087502	44
17	9.801510	9.888755	9.912756	10.087244	43
18	9.801665	9.888651	9.913014	10.086986	42
19	9.801819	9.888548	9.913271	10.086729	41
20	9.801973	9.888444	9.913529	10.086471	40
21	9.802127	9.888341	9.913787	10.086213	39
22	9.802282	9.888237	9.914044	10.085956	38
23	9.802435	9.888133	9.914302	10.085698	37
24	9.802589	9.888030	9.914560	10.085440	36
25	9.802743	9.887926	9.914817	10.085183	35
26	9.802897	9.887822	9.915075	10.084925	34
27	9.803050	9.887718	9.915332	10.084668	33
28	9.803204	9.887614	9.915590	10.084410	32
29	9.803357	9.887510	9.915847	10.084153	31
30	9.803510	9.887406	9.916104	10.083895	30
	Co-ſine	Sine	*Co-tang*	Tangent	M

Degree 50.

Degree 39.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.803510	9.887406	9.916104	10.083895	30
31	9.803664	9.887302	9.916362	10.083638	29
32	9.803817	9.887198	9.916619	10.083381	28
33	9.803970	9.887093	9.916876	10.083123	27
34	9.804123	9.887909	9.917134	10.082866	26
35	9.804276	9.886884	9.917391	10.082609	25
36	9.804428	9.886780	9.917648	10.082352	24
37	9.804586	9.886675	9.917905	10.082094	23
38	9.804734	9.886561	9.918162	10.081837	22
39	9.804886	9.886466	9.918420	10.081580	21
40	9.805038	9.886361	9.918677	10.081323	20
41	9.805191	9.886257	9.918934	10.081 66	19
42	9.805343	9.886152	9.919191	10.080809	18
43	9.805495	9.886047	9.919448	10.080552	17
44	9.805647	9.885642	9.919705	10.080295	16
45	9.805799	9.885837	9.919962	10.080038	15
46	9.805951	9.885732	9.920219	10.079781	14
47	9.806103	9.885627	9.920476	10.079524	13
48	9.806254	9.885521	9.920733	10.079267	12
49	9.806406	9.885416	9.920990	10.079010	11
50	9.806557	9.885311	9.921247	10.078753	10
51	9.806709	9.885205	9.921503	10.078496	9
52	9.806860	9.885100	9.921760	10.078240	8
53	9.807011	9.884994	9.922017	10.077983	7
54	9.807162	9.884889	9.922274	10.077726	6
55	9.807314	9.884783	9.922530	10.077469	5
56	9.807464	9.884677	9.922787	10.077213	4
57	9.807615	9.884572	9.923044	10.076956	3
58	9.807766	9.884466	9.923300	10.076699	2
59	9.807917	9.884360	9.923557	10.076443	1
60	9.808067	9.884254	9.923813	10 076186	
	Co-sine	Sine	Co-tang.	Tangent.	M

Degree 50.

Degree 40.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9,808067	9,884254	9,923813	10,076186	60
1	9,808218	9,884188	9,924070	10,075930	59
2	9,808368	9,884049	9,924327	10,075673	58
3	9,808519	9,883936	9,924583	10,075417	57
4	9,808669	9,883829	9,924839	10,075160	56
5	9,808819	9,883723	9,925096	10,074904	55
6	9,808969	9,883617	9,925352	10,074647	54
7	9,809119	9,883510	9,925609	10,074391	53
8	9,809269	9,883404	9,925865	10,074135	52
9	9,809419	9,883297	9,926121	10,073878	51
10	9,809569	9,883191	9,926378	10,073622	50
11	9,809718	9,883084	9,926634	10,073366	49
12	9,809868	9,882977	9,926890	10,073110	48
13	9,810017	9,882871	9,927147	10,072853	47
14	9,810166	9,882764	9,927403	10,072597	46
15	9,810316	9,882659	9,927659	10,072341	45
16	9,810465	9,882550	9,927915	10,072085	44
17	9,810614	9,882443	9,928171	10,071829	43
18	9,810763	9,882336	9,928427	10,071573	42
19	9,810912	9,882228	9,928683	10,071317	41
20	9,810061	9,882121	9,928940	10,071060	40
21	9,811210	9,882014	9,929196	10,070804	39
22	9,811358	9,881907	9,929452	10,070540	38
23	9,811506	9,881799	9,929708	10,070292	37
24	9,811655	9,881692	9,929964	10,070036	36
25	9,811804	9,881584	9,920219	10,069781	35
26	9,811952	9,881477	9,930475	10,069525	34
27	9,812100	9,881369	9,930731	10,069269	33
28	9,812248	9,881261	9,930987	10,069013	32
29	9,812396	9,881153	9,931243	10,068757	31
30	9,812544	9,881045	9,931499	10,068501	30
	Co-sine	Sine	Co-tang.	Tangent.	M

Degree 49.

Degree 40.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9,812544	9,881045	9,931499	10,068501	30
31	9,812692	9,880937	9,931755	10,068245	29
32	9,812840	9,880829	9,932010	10,067989	28
33	9,812988	9,880721	9,932266	10,067734	27
34	9,813135	9,880613	9,932522	10,067478	26
35	9,813283	9,880505	9,932778	10,067222	25
36	9,813430	9,880397	9,933033	10,066967	24
37	9,813578	9,880289	9,933289	10,066711	23
38	9,813725	9,880180	9,933545	10,066455	22
39	9,813872	9,880072	9,933800	10,066200	21
40	9,814019	9,879963	9,934056	10,065944	20
41	9,814166	9,879855	9,934311	10,065688	19
42	9,814313	9,879746	9,934567	10,065433	18
43	9,814460	9,879637	9,934822	10,065177	17
44	9,814607	9,879529	9,935078	10,064922	16
45	9,814753	9,879420	9,935333	10,064666	15
46	9,814900	9,879311	9,935589	10,064411	14
47	9,815046	9,879202	9,935844	10,064156	13
48	9,815193	9,879093	9,936100	10,063900	12
49	9,815339	9,878984	9,936355	10,063645	11
50	9,815485	9,878875	9,936610	10,063389	10
51	9,815631	9,878766	9,936866	10,063134	9
52	9,815777	9,878656	9,937121	10,062879	8
53	9,815923	9,878547	9,937376	10,062623	7
54	9,816069	9,878438	9,937632	10,062368	6
55	9,816215	9,878328	9,937887	10,062113	5
56	9,816361	9,878219	9,938142	10,061858	4
57	9,816506	9,878109	9,938397	10,061602	3
58	9,816652	9,877999	9,938653	10,061347	2
59	9,816797	9,877890	9,938908	10,061092	1
60	,9816943	9,877780	9,939163	10,060837	0
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 49.

Degree 41.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
0	9,816943	9,877780	9,939163	10,060837	60
1	9,817088	9,877670	9,939418	10,060582	59
2	9,817233	9,877560	9,939673	10,060327	58
3	9,817378	9,877450	9,939928	10,060072	57
4	9,817523	9,877340	9,940183	10,059816	56
5	9,817668	9,877230	9,940438	10,059562	55
6	9,817813	9,877120	9,940693	10,059307	54
7	9,817958	9,877003	9,940948	10,059052	53
8	9,818103	9,876899	9,941203	10,058797	52
9	9,818247	9,876789	9,941458	10,058542	51
10	9,818392	9,876678	9,941713	10,058287	50
11	9,818536	9,876568	9,441968	10,058032	49
12	9,818681	9,876457	9,942223	10,057777	48
13	9,818825	9,876347	9,942478	10,057522	47
14	9,818969	9,876256	9,942733	10,057267	46
15	9,818113	9,876125	9,942488	10,057012	45
16	9,819257	9,876014	9,943243	10,056757	44
17	9,819401	9,875904	9,943498	10,056502	43
18	9,819545	9,875793	9,943752	10,056248	42
19	9,819689	9,875682	9,944007	10,055993	41
20	9,819832	9,875571	9,944262	10,055738	40
21	9,819976	9,875459	9,944517	10,055483	39
22	9,820119	9,875348	9,944771	10,055229	38
23	9,820263	9,875237	9,945026	10,054974	37
24	9,820406	9,875125	9,945281	10,054719	36
25	9,820549	9,875014	9,945535	10,054464	35
26	9,820693	9,874903	9,945790	10,054210	34
27	9,820836	9,874791	9,946045	10,053955	33
28	9,820979	9,874679	9,946299	10,053701	32
29	9,821122	9,874568	9,946554	10,053446	31
30	9,821264	9,874456	9,946808	10,053192	30
	Co-ſine	Sine	*Co-tang.*	Tangent.	

Degree 48.

Degree 41.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.821264	9.874456	9.946808	10.053192	30
31	9.821407	9.874344	9.947063	10.052937	29
32	9.821550	9.874232	9.947317	10.052682	28
33	9.821692	9.874120	9.947572	10.052428	27
34	9.821835	9.874008	9.947826	10.052173	26
35	9.821977	9.873896	9.948081	10.051919	25
36	9.822120	9.873784	9.948335	10.051664	24
37	9.822262	9.873672	9.948590	10.051410	23
38	9.822404	9.873560	9.948844	10.051156	22
39	9.822546	9.873447	9.949099	10.050901	21
40	9.822688	9.873335	9.949353	10.050647	20
41	9.822830	9.873223	9.949607	10.050393	19
42	9.822972	9.873110	9.949862	10.050138	18
43	9.823114	9.872998	9.950116	10.049884	17
44	9.823255	9.872885	9.950370	10.049630	16
45	9.823397	9.872772	9.950625	10.049375	15
46	9.823538	9.872659	9.950879	10.049121	14
47	9.823680	9.872546	9.951133	10.048867	13
48	9.823821	9.872434	9.951388	10.048612	12
49	9.823962	9.872321	9.951642	10.048358	11
50	9.824104	9.872208	9.951896	10.048104	10
51	9.824245	9.872094	9.952150	10.047850	9
52	9.824386	9.871981	9.952404	10.047575	8
53	9.824527	9.871868	9.952659	10.047341	7
54	9.824667	9.871755	9.952913	10.047087	6
55	9.824808	9.871641	9.953167	10 046833	5
56	9.824949	9.871528	9.953421	10.046579	4
57	9.825090	9.871414	9.953675	10.046325	3
58	9.825230	9.871301	9.953929	10.046071	2
59	9.825370	9.871187	9.954183	10.045817	1
60	9.825511	9.871073	9.954437	10,045562	0
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 48.

Degree 42.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9.825511	9.871073	9.954437	10.045562	60
1	9.825651	9.870960	9.954691	10.045308	59
2	9.825791	9.870846	9.954945	10.045054	58
3	9.825931	9.870732	9.955199	10.044800	57
4	9.826071	9.870618	9.955453	10.044546	56
5	9.826211	9.870504	9.955707	10.044292	55
6	9.826351	9.870390	9.955961	10.044038	54
7	9.826491	9.870271	9.956215	10.043784	53
8	9.826631	9.870161	9.956469	10.043531	52
9	9.826770	9.870047	9.956723	10.043276	51
10	9.826910	9.869933	9.956977	10.043023	50
11	9.827049	9.869818	9.957231	10.042769	49
12	9.827189	9.869704	9.957485	10.042515	48
13	9.827328	9.869589	9.957739	10.042261	47
14	9.827467	9.869474	9.957993	10.042007	46
15	9.827606	9.869360	9.958246	10.041753	45
16	9.827745	9.869245	9.958500	10.041500	44
17	9.827884	9.869130	9.958754	10.041246	43
18	9.828023	9.869015	9.959008	10.040992	42
19	9.828162	9.868900	9.956262	10.040738	41
20	9.828301	9.868785	9.959515	10.040485	40
21	9.828439	9.868670	9.959769	10.040231	39
22	9.828578	9.868555	9.960023	10.039977	38
23	9.828716	9.868439	9.960277	10.039723	37
24	9.828855	9.868324	9.960530	10.039469	36
25	9.828993	9.868209	9.960784	10.039216	35
26	9.829131	9.868093	9.961038	10.038962	34
27	9.829269	9.867978	9.961291	10.038608	33
28	9.829407	9.867862	9.961545	10.038451	32
29	9.829545	9.867747	9.961799	10.038201	31
30	9.829683	9.867631	9.962052	10.037947	30
	Co-ſine	Sine	Co-tang.	Tangent.	M

Degree 47.

Degree 42.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.829683	9.867631	9.962052	10.037947	30
31	9.829821	9.867515	9.962306	10.037694	29
32	9.829959	9.867399	9.962560	10.037440	28
33	9.830096	9.867283	9.962813	10.037187	27
34	9.830234	9.867167	9.963067	10.036933	26
35	9.830372	9.867051	9.963320	10.036680	25
36	9.830509	9.866935	9.963574	10.036426	24
37	9.830646	9.866819	9.963827	10.036173	23
38	9.830784	9.866703	9.964081	10.035919	22
39	9.830921	9.866586	9.964335	10.035665	21
40	9.831058	9.866470	9.964588	10.035412	20
41	9.831195	9.866353	9.964842	10.035158	19
42	9.831332	9.866237	9.965095	10.034905	18
43	9.831469	9.866120	9.965348	10.034652	17
44	9.831606	9.866004	9.965602	10.034398	16
45	9.831742	9.865887	9.965855	10.034144	15
46	9.831879	9.865770	9.966109	10.033891	14
47	9.832015	9.865653	9.966362	10.033638	13
48	9.832152	9.865536	9.966616	10.033384	12
49	9.832288	9.865419	9.966869	10.033131	11
50	9.832425	9.865302	9.967122	10.032878	10
51	9.832561	9.865185	9.967376	10.032624	9
52	9.832697	9.865068	9.967629	10.032371	8
53	9.832833	9.864950	9.967883	10.032117	7
54	9.832969	9.864833	9.968136	10.031864	6
55	9.833105	9.864716	9.968389	10.031611	5
56	9.833241	9.864598	9.968643	10.031357	4
57	9.833376	9.864480	9.968896	10.031104	3
58	9.833512	9.864363	9.969146	10.030851	2
59	9.833648	9.864245	9.969403	10.030597	1
60	9.833783	9.864127	9.969656	10.030344	0
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 47.

Degree 43.

M	Sine	*Co-ſine*	Tangent	*Co-tang*	
0	9.833783	9.864127	9.969656	10.030344	60
1	9.833919	9.864010	9.969909	10.030091	59
2	9.834054	9.863892	9.970162	10.029838	58
3	9.834189	9.863774	9.970416	10.029584	57
4	9.834324	9.863656	9.970669	10.029331	56
5	9.834460	9.863537	9.970922	10.029078	55
6	9.834595	9.863419	9.971175	10.028827	54
7	9.834730	9.863301	9.971428	10.028571	53
8	9.834865	9.863183	9.971682	10.028318	52
9	9.834999	9.863064	9.971935	10.028065	51
10	9.835134	9 862946	9.972188	10.027812	50
11	9.835269	9.862827	9.972441	10.027559	49
12	9.835503	9.862709	9.972694	10.027306	48
13	9.835538	9.862590	9.972948	10.027052	47
14	9.835672	9.862471	9.973201	10.026799	46
15	9.835806	9.862353	9.973454	10.026546	45
16	9.835941	9.862234	9.973707	10.026293	44
17	9.836075	9.862115	9.973960	10.026040	43
18	9.836209	9.861996	9.974213	10.025787	42
19	9.836343	9.861877	9.974466	10.025533	41
20	9.836477	9.861757	9.974719	10.025280	40
21	9.836611	9.861638	9.974973	10.025027	39
22	9.836745	9.861519	9.975229	10.024774	38
23	9.836878	9 861399	9.975479	10.024521	37
24	9.837012	9.861280	9.975732	10.024268	36
25	9.837146	9.861161	9.975985	10.024015	35
26	9.837279	9.861041	9.976238	10.023762	34
27	9.837412	9.860921	9.976491	10.023509	33
28	9.837546	9.860802	9.976744	10.023256	32
29	9 837679	9.860682	9.976997	10.023003	31
30	9 837812	9 860562	9.977250	10.022750	30
	Co-ſine	Sine	*Co-tang*	Tangent	M

Degree 46.

Degree 43.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
30	9.837812	9.860562	9.977250	10.022750	30
31	9.837945	9.860442	9.977503	10.022497	29
32	9.838078	9.860322	9.977756	10.022244	28
33	9.838211	9.860202	9.978009	10.021991	27
34	9.838344	9.860082	9.978262	10.021738	26
35	9.838477	9.859562	9.978515	10.021485	25
36	9.838609	9.859842	9.979768	10.020232	24
37	9.838742	9.859721	9.979021	10.020979	23
38	9.838875	9.859601	9.979274	10.020726	22
39	9.839005	9.859580	9 979527	10.020473	21
40	9.839140	9.859360	9.979780	10.020220	20
41	9.839272	9.859239	9.980033	10.019967	19
42	9.839484	9.859118	9.980285	10.019714	18
43	9.839536	9.858998	9.980538	10.019461	17
44	9.839668	9.858877	9.980791	10.019209	16
45	9.839800	9.858756	9.981044	10.018956	15
46	9.839932	9.858639	9.981297	10.018703	14
47	9.840064	9.858514	9.981550	10.018450	13
48	9.840196	9.858398	9.981803	10.018197	12
49	9.840428	9.858272	9.982056	10.017944	11
50	9.840459	9,858150	9.982309	10.017691	10
51	9.840591	9.858029	9.982552	10.017438	9
52	9.840722	9.857908	9.982814	10.017185	8
53	9.840854	9.857786	9.983067	10.016933	7
54	9.840985	9.857665	9.983320	10.016680	6
55	9.841116	9.857543	9.983573	10.016427	5
56	9.841247	9.857421	9.983826	10.016174	4
57	9.841378	9.857300	9.984079	10.015921	3
58	9.841509	9.857158	9.984331	10.015668	2
59	9.841640	9.857056	9.984584	10.015416	1
60	9 841771	9.856634	9.984837	10.015163	0
	Co-ſine	Sine	*Co-tang.*	Tangent	M

Degree 46.

Degree 44.

M	Sine	Co-ſine	Tangent	Co-tang.	
0	9,841771	9,856934	9,984837	10,015162	60
1	9,841902	9,856812	9,985090	10,014910	59
2	9,842033	9,856690	9,985343	10,014657	58
3	9,842163	9,856568	9,985596	10,014404	57
4	9,842294	9,856445	9,985848	10,014151	56
5	9,842424	9,856323	9,986101	10,013899	55
6	9,842555	9,856201	9,986354	10,013646	54
7	9,842685	9,856078	9,986607	10,013393	53
8	9,842815	9,855956	9,986859	10,013140	52
9	9,842945	9,855833	9,987112	10,012888	51
10	9,843076	9,855710	9,987365	10,012635	50
11	9,843206	9,855588	9,987618	10,012382	49
12	9,843336	9,855465	9,987871	10,012129	48
13	9,843465	9,855342	9,988123	10,011877	47
14	9,843595	9,855218	9,988376	10,011624	46
15	9,843725	9,855096	9,988629	10,011371	45
16	9,843855	9,854973	9,988887	10,011118	44
17	9,843984	9,854850	9,989134	10,010866	43
18	9,844114	9,854727	9,989387	10,010613	42
19	9,844243	9,854603	9,989640	10,010360	41
20	9,844372	9,854480	9,989893	10,010107	40
21	9,844502	9,854356	9,990145	10,009855	39
22	9,844631	9,854233	9,990398	10,009602	38
23	9,844760	9,854109	9,990951	10,009349	37
24	9,844889	9,853986	9,990903	10,009096	36
25	9,845018	9,853862	9,991156	10,008844	35
26	9,845147	9,853738	9,991409	10,008592	34
27	9,845276	9,853614	9,991662	10,008338	33
28	9,845404	9,853590	9,991914	10,008086	32
29	9,845533	9,853266	9,992167	10,007833	31
30	9,845662	9,853242	9,992420	10,007580	30
	Co-ſine	Sine	Co-tang.	Tangent	M

Degree 45.

Degree 44.

M	Sine	*Co-ſine.*	Tangent	*Co-tang.*	
30	9,845662	9,853242	9,992420	10,007580	30
31	9,845790	9,853118	9,992672	10,007328	29
32	9,845919	9,852994	9,992925	10,007075	28
3	9,846047	9,852869	9,993178	10,006822	27
34	9,846175	9,852745	9,993430	10,006565	26
35	9,846304	9,852620	9,993683	10,006317	25
36	9,846432	9,842496	9,993936	10,006064	24
37	9,846560	9,852371	9,994189	10,005811	23
38	9,846688	9,852240	9,994441	10,005559	22
39	9,846816	9,852122	9,994694	10,005306	21
40	9,846944	9,851997	9,994947	10,005053	20
41	9,847071	9,851872	9,995199	10,004801	19
42	9,847199	9,851747	9,995452	10,004548	18
43	9,847327	9,851622	9,995701	10,004295	17
44	9,847454	9,851497	9,995957	10,004043	16
45	9,847582	9,851372	9,996210	10,003790	15
46	9,847709	9,851246	9,996463	10,003537	14
47	9,847836	9,851121	9,996715	10,003285	13
48	9,847964	9,850996	9,996968	10,003032	12
49	9,848091	9,850870	9,997220	10,002779	11
50	9,848218	9,850745	9,997473	10,002527	10
51	9,848345	9,850619	9,997726	10,002274	9
52	9,848472	9,850493	9,997979	10,002021	8
53	9,848599	9,850367	9,998231	10,001769	7
54	9,848726	9,850242	9,998484	10,001516	6
55	9,848852	9,850116	9,998737	10,001263	5
56	9,848979	9,849990	9,998989	10,001011	4
57	9,849106	9,849864	9,999242	10,001758	3
58	9,849232	9,849737	9,999495	10,000505	2
59	9,849359	9,849611	9,999747	10,000253	1
60	9,849485	9,849485	10,000000	10,000000	0
	Co-ſine	Sine	*Co-tang.*	Tangent.	M

Degree 45.